ISSUE NO :

Rev: 002

**Product Family Data Sheet**

# LM362A – CRI 90





## Introduction

## Features

- Beam Angle: 120˚
- Precondition : JEDEC Level 2a
- Dimension : 3.6 x 2.3 x 0.6 mm
- ESD withstand Voltage : up to ±5KV [HBM]
- Reliability Test : Refer to page 25

**SAMSUNG ELECTRONICS**
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# 1. Product Code Information

## 1) Luminous Flux Bins ($T_s$ = 25℃)

| Nominal CCT | Product Code | Flux Rank | Sorting Condition Im @100mA | |
|---|---|---|---|---|
| | | | Flux Bin | Intensity Range (cd) |
| | | | | Flux Range ($\Phi_v$, lm) |
| 2700K | SPMWHT325AD7YBW0S0 | S0 | S1 | 48.00 ~ 53.00 |
| | | | S2 | 53.00 ~ 58.00 |
| | | | S3 | 58.00 ~ 63.00 |
| 3000K | SPMWHT325AD7YBV0S0 | S0 | S1 | 50.00 ~ 55.00 |
| | | | S2 | 55.00 ~ 60.00 |
| | | | S3 | 60.00 ~ 65.00 |
| 3500K | SPMWHT325AD7YBU0S0 | S0 | S1 | 52.00 ~ 57.00 |
| | | | S2 | 57.00 ~ 62.00 |
| | | | S3 | 62.00 ~ 67.00 |
| 4000K | SPMWHT325AD7YBT0S0 | S0 | S1 | 54.00 ~ 59.00 |
| | | | S2 | 59.00 ~ 64.00 |
| | | | S3 | 64.00 ~ 69.00 |

**Notes:**

1) Luminous Intensity($I_v$, cd) values are for representative reference only

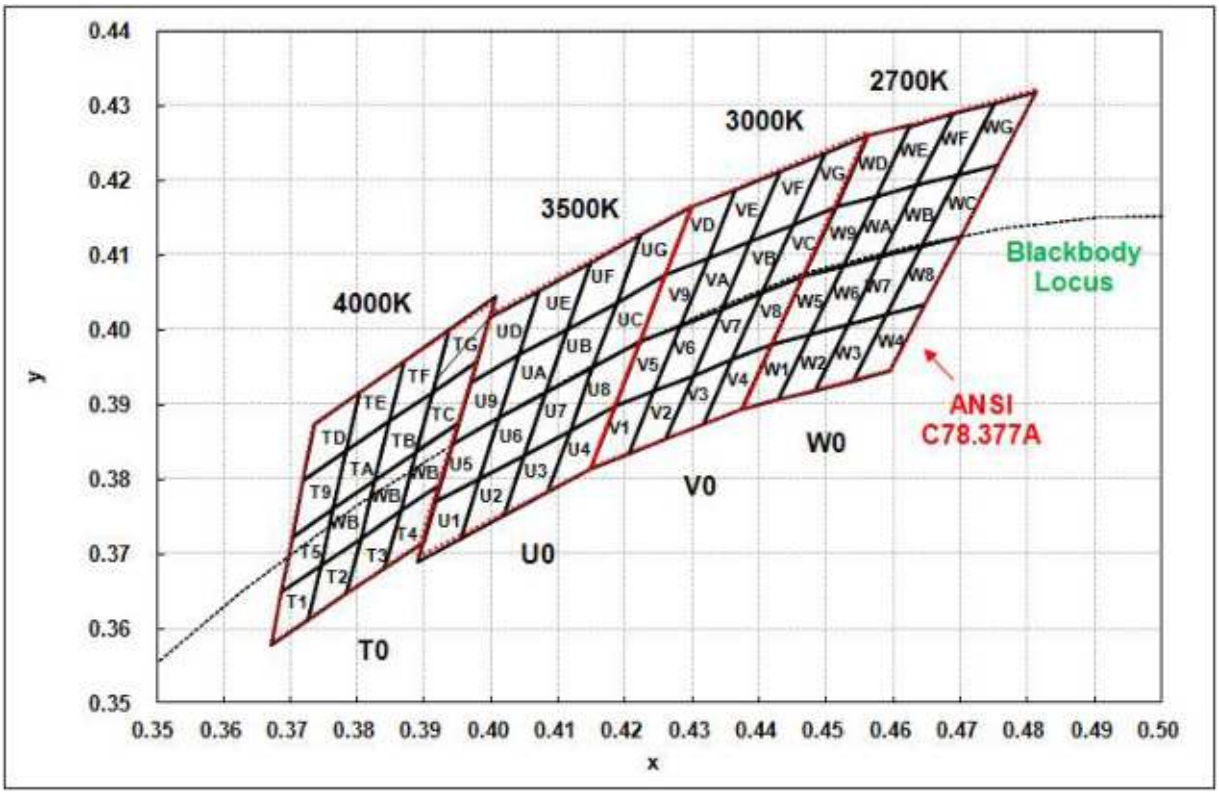
2) SAMSUNG ELECTRONICS maintains a tolerance of ±5% on Luminous Flux measurement

## 2) Color Bins (Ts = 25℃)

### 1) Color Binning

| Nominal CCT | Product Code | Color Rank | Chromaticity Bins |
|---|---|---|---|
| 2700K | SPMWHT325AD7YBW0S0 | W0 (Whole Bin) | W1,W2,W3,W4,W5,W6,W7,W8, W9,WA,WB,WC,WD,WE,WF,WG |
| 3000K | SPMWHT325AD7YBV0S0 | V0 (Whole Bin) | V1,V2,V3,V4,V5,V6,V7,V8, V9,VA,VB,VC,VD,VE,VF,VG |
| 3500K | SPMWHT325AD7YBU0S0 | U0 (Whole Bin) | U1,U2,U3,U4,U5,U6,U7,U8, U9,UA,UB,UC,UD,UE,UF,UG |
| 4000K | SPMWHT325AD7YBT0S0 | T0 (Whole Bin) | T1,T2,T3,T4,T5,T6,T7,T8, T9,TA,TB,TC,TD,TE,TF,TG |

2) Chromaticity Region & Coordinates



## 2) Chromaticity Region & Coordinates (Continued)

| Region | CIE X | CIE Y | Region | CIE X | CIE Y |
|---|---|---|---|---|---|
| W rank (2700K) | | | | | |
| W1 | 0.4373 | 0.3893 | W9 | 0.4465 | 0.4071 |
| | 0.4418 | 0.3981 | | 0.4513 | 0.4164 |
| | 0.4475 | 0.3994 | | 0.4573 | 0.4178 |
| | 0.4428 | 0.3906 | | 0.4523 | 0.4085 |
| W2 | 0.4428 | 0.3906 | WA | 0.4523 | 0.4085 |
| | 0.4475 | 0.3994 | | 0.4573 | 0.4178 |
| | 0.4532 | 0.4008 | | 0.4634 | 0.4193 |
| | 0.4483 | 0.3919 | | 0.4582 | 0.4099 |
| W3 | 0.4483 | 0.3919 | WB | 0.4582 | 0.4099 |
| | 0.4532 | 0.4008 | | 0.4634 | 0.4193 |
| | 0.4589 | 0.4021 | | 0.4695 | 0.4207 |
| | 0.4538 | 0.3931 | | 0.4641 | 0.4112 |
| W4 | 0.4538 | 0.3931 | WC | 0.4641 | 0.4112 |
| | 0.4589 | 0.4021 | | 0.4695 | 0.4207 |
| | 0.4646 | 0.4034 | | 0.4756 | 0.4221 |
| | 0.4593 | 0.3944 | | 0.4700 | 0.4126 |
| W5 | 0.4418 | 0.3981 | WD | 0.4513 | 0.4164 |
| | 0.4465 | 0.4071 | | 0.4562 | 0.4260 |
| | 0.4523 | 0.4085 | | 0.4624 | 0.4274 |
| | 0.4475 | 0.3994 | | 0.4573 | 0.4178 |
| W6 | 0.4475 | 0.3994 | WE | 0.4573 | 0.4178 |
| | 0.4523 | 0.4085 | | 0.4624 | 0.4274 |
| | 0.4582 | 0.4099 | | 0.4687 | 0.4289 |
| | 0.4532 | 0.4008 | | 0.4634 | 0.4193 |
| W7 | 0.4532 | 0.4008 | WF | 0.4634 | 0.4193 |
| | 0.4582 | 0.4099 | | 0.4687 | 0.4289 |
| | 0.4641 | 0.4112 | | 0.4750 | 0.4304 |
| | 0.4589 | 0.4021 | | 0.4695 | 0.4207 |
| W8 | 0.4589 | 0.4021 | WG | 0.4695 | 0.4207 |
| | 0.4641 | 0.4112 | | 0.4750 | 0.4304 |
| | 0.4700 | 0.4126 | | 0.4813 | 0.4319 |
| | 0.4646 | 0.4034 | | 0.4756 | 0.4221 |

| Region | CIE X | CIE Y | Region | CIE X | CIE Y |
|---|---|---|---|---|---|
| V rank (3000K) | | | | | |
| V1 | 0.4147 | 0.3814 | V9 | 0.4221 | 0.3984 |
| | 0.4183 | 0.3898 | | 0.4259 | 0.4073 |
| | 0.4242 | 0.3919 | | 0.4322 | 0.4096 |
| | 0.4203 | 0.3833 | | 0.4281 | 0.4006 |
| V2 | 0.4203 | 0.3833 | VA | 0.4281 | 0.4006 |
| | 0.4242 | 0.3919 | | 0.4322 | 0.4096 |
| | 0.4300 | 0.3939 | | 0.4385 | 0.4119 |
| | 0.4259 | 0.3853 | | 0.4342 | 0.4028 |
| V3 | 0.4259 | 0.3853 | VB | 0.4342 | 0.4028 |
| | 0.4300 | 0.3939 | | 0.4385 | 0.4119 |
| | 0.4359 | 0.3960 | | 0.4449 | 0.4141 |
| | 0.4316 | 0.3873 | | 0.4403 | 0.4049 |
| V4 | 0.4316 | 0.3873 | VC | 0.4403 | 0.4049 |
| | 0.4359 | 0.3960 | | 0.4449 | 0.4141 |
| | 0.4418 | 0.3981 | | 0.4513 | 0.4164 |
| | 0.4373 | 0.3893 | | 0.4465 | 0.4071 |
| V5 | 0.4183 | 0.3898 | VD | 0.4259 | 0.4073 |
| | 0.4221 | 0.3984 | | 0.4299 | 0.4165 |
| | 0.4281 | 0.4006 | | 0.4364 | 0.4188 |
| | 0.4242 | 0.3919 | | 0.4322 | 0.4096 |
| V6 | 0.4242 | 0.3919 | VE | 0.4322 | 0.4096 |
| | 0.4281 | 0.4006 | | 0.4364 | 0.4188 |
| | 0.4342 | 0.4028 | | 0.4430 | 0.4212 |
| | 0.4300 | 0.3939 | | 0.4385 | 0.4119 |
| V7 | 0.4300 | 0.3939 | VF | 0.4385 | 0.4119 |
| | 0.4342 | 0.4028 | | 0.4430 | 0.4212 |
| | 0.4403 | 0.4049 | | 0.4496 | 0.4236 |
| | 0.4359 | 0.3960 | | 0.4449 | 0.4141 |
| V8 | 0.4359 | 0.3960 | VG | 0.4449 | 0.4141 |
| | 0.4403 | 0.4049 | | 0.4496 | 0.4236 |
| | 0.4465 | 0.4071 | | 0.4562 | 0.4260 |
| | 0.4418 | 0.3981 | | 0.4513 | 0.4164 |

## 2) Chromaticity Region & Coordinates (Continued)

| Region | CIE X | CIE Y | Region | CIE X | CIE Y |
|---|---|---|---|---|---|
| U rank (3500K) | | | | | |
| U1 | 0.3889 | 0.3690 | U9 | 0.3941 | 0.3848 |
| | 0.3953 | 0.3720 | | 0.4010 | 0.3882 |
| | 0.3981 | 0.3800 | | 0.4040 | 0.3966 |
| | 0.3915 | 0.3768 | | 0.3968 | 0.3930 |
| U2 | 0.3953 | 0.3720 | UA | 0.4010 | 0.3882 |
| | 0.4017 | 0.3751 | | 0.4080 | 0.3916 |
| | 0.4048 | 0.3832 | | 0.4113 | 0.4001 |
| | 0.3981 | 0.380 | | 0.4040 | 0.3966 |
| U3 | 0.4017 | 0.3751 | UB | 0.4080 | 0.3916 |
| | 0.4082 | 0.3782 | | 0.4150 | 0.3950 |
| | 0.4116 | 0.3865 | | 0.4186 | 0.4037 |
| | 0.4048 | 0.3832 | | 0.4113 | 0.4001 |
| U4 | 0.4082 | 0.3782 | UC | 0.4150 | 0.3950 |
| | 0.4147 | 0.3814 | | 0.4221 | 0.3984 |
| | 0.4183 | 0.3898 | | 0.4259 | 0.4073 |
| | 0.4116 | 0.3865 | | 0.4186 | 0.4037 |
| U5 | 0.3915 | 0.3768 | UD | 0.3968 | 0.3930 |
| | 0.3981 | 0.3800 | | 0.4040 | 0.3966 |
| | 0.4010 | 0.3882 | | 0.4071 | 0.4052 |
| | 0.3941 | 0.3848 | | 0.3996 | 0.4015 |
| U6 | 0.3981 | 0.3800 | UE | 0.4040 | 0.3966 |
| | 0.4048 | 0.3832 | | 0.4113 | 0.4001 |
| | 0.4080 | 0.3916 | | 0.4146 | 0.4089 |
| | 0.4011 | 0.3882 | | 0.4071 | 0.4052 |
| U7 | 0.4048 | 0.3832 | UF | 0.4113 | 0.4001 |
| | 0.4116 | 0.3865 | | 0.4186 | 0.4037 |
| | 0.4150 | 0.3950 | | 0.4222 | 0.4127 |
| | 0.4080 | 0.3916 | | 0.4146 | 0.4089 |
| U8 | 0.4116 | 0.3865 | UG | 0.4186 | 0.4037 |
| | 0.4183 | 0.3898 | | 0.4259 | 0.4073 |
| | 0.4221 | 0.3984 | | 0.4299 | 0.4165 |
| | 0.4150 | 0.3950 | | 0.4222 | 0.4127 |

| Region | CIE X | CIE Y | Region | CIE X | CIE Y |
|---|---|---|---|---|---|
| T rank (4000K) | | | | | |
| T1 | 0.3670 | 0.3578 | T9 | 0.3702 | 0.3722 |
| | 0.3726 | 0.3612 | | 0.3763 | 0.3760 |
| | 0.3744 | 0.3685 | | 0.3782 | 0.3837 |
| | 0.3686 | 0.3649 | | 0.3719 | 0.3797 |
| T2 | 0.3726 | 0.3612 | TA | 0.3763 | 0.3760 |
| | 0.3783 | 0.3646 | | 0.3825 | 0.3798 |
| | 0.3804 | 0.3721 | | 0.3847 | 0.3877 |
| | 0.3744 | 0.3685 | | 0.3782 | 0.3837 |
| T3 | 0.3783 | 0.3646 | TB | 0.3825 | 0.3798 |
| | 0.3840 | 0.3681 | | 0.3887 | 0.3836 |
| | 0.3863 | 0.3758 | | 0.3912 | 0.3917 |
| | 0.3804 | 0.3721 | | 0.3847 | 0.3877 |
| T4 | 0.3840 | 0.3681 | TC | 0.3887 | 0.3837 |
| | 0.3898 | 0.3716 | | 0.3950 | 0.3875 |
| | 0.3924 | 0.3794 | | 0.3978 | 0.3958 |
| | 0.3863 | 0.3758 | | 0.3912 | 0.3917 |
| T5 | 0.3686 | 0.3649 | TD | 0.3719 | 0.3797 |
| | 0.3744 | 0.3685 | | 0.3782 | 0.3837 |
| | 0.3763 | 0.3760 | | 0.3802 | 0.3916 |
| | 0.3702 | 0.3722 | | 0.3736 | 0.3874 |
| T6 | 0.3744 | 0.3685 | TE | 0.3782 | 0.3837 |
| | 0.3804 | 0.3721 | | 0.3847 | 0.3877 |
| | 0.3825 | 0.3798 | | 0.3869 | 0.3958 |
| | 0.3763 | 0.3760 | | 0.3802 | 0.3916 |
| T7 | 0.3804 | 0.3721 | TF | 0.3847 | 0.3877 |
| | 0.3863 | 0.3758 | | 0.3912 | 0.3917 |
| | 0.3887 | 0.3836 | | 0.3937 | 0.4001 |
| | 0.3825 | 0.3798 | | 0.3869 | 0.3958 |
| T8 | 0.3863 | 0.3758 | TG | 0.3912 | 0.3917 |
| | 0.3924 | 0.3794 | | 0.3978 | 0.3958 |
| | 0.3950 | 0.3875 | | 0.4006 | 0.4044 |
| | 0.3887 | 0.3836 | | 0.3937 | 0.4001 |

## 2. Luminous Flux Characteristics (Ts = 25℃)

| Nominal CCT | Minimum CRI[1)] | If(mA) | Vf(V) | Power(W) | Flux(lm) | lm/W |
|---|---|---|---|---|---|---|
| 2700K | 90 | 50 | 5.71 | 0.29 | 32 | 109 |
| | | 100 | 5.96 | 0.60 | 58 | 96 |
| | | 110 | 5.99 | 0.66 | 62 | 94 |
| | | 120 | 6.03 | 0.72 | 67 | 93 |
| | | 130 | 6.06 | 0.79 | 71 | 90 |
| | | 140 | 6.09 | 0.85 | 75 | 86 |
| | | 150 | 6.11 | 0.92 | 79 | 85 |
| | | 160 | 6.14 | 0.98 | 83 | 83 |
| | | 170 | 6.17 | 1.05 | 87 | 81 |
| | | 180 | 6.20 | 1.12 | 91 | 80 |
| | | 190 | 6.23 | 1.18 | 94 | 80 |
| | | 200 | 6.27 | 1.25 | 98 | 78 |
| 3000K | 90 | 50 | 5.71 | 0.29 | 33 | 112 |
| | | 100 | 5.96 | 0.60 | 59 | 99 |
| | | 110 | 5.99 | 0.66 | 64 | 97 |
| | | 120 | 6.03 | 0.72 | 69 | 95 |
| | | 130 | 6.06 | 0.79 | 73 | 93 |
| | | 140 | 6.09 | 0.85 | 77 | 91 |
| | | 150 | 6.11 | 0.92 | 81 | 88 |
| | | 160 | 6.14 | 0.98 | 86 | 87 |
| | | 170 | 6.17 | 1.05 | 90 | 85 |
| | | 180 | 6.20 | 1.12 | 94 | 84 |
| | | 190 | 6.23 | 1.18 | 97 | 82 |
| | | 200 | 6.27 | 1.25 | 101 | 80 |

## 2. Luminous Flux Characteristics (Ts = 25℃)

| Nominal CCT | Minimum CRI[1)] | If(mA) | Vf(V) | Power(W) | Flux(lm) | lm/W |
|---|---|---|---|---|---|---|
| 3500K | 90 | 50 | 5.71 | 0.29 | 34 | 116 |
| | | 100 | 5.96 | 0.60 | 61 | 102 |
| | | 110 | 5.99 | 0.66 | 66 | 100 |
| | | 120 | 6.03 | 0.72 | 71 | 98 |
| | | 130 | 6.06 | 0.79 | 75 | 95 |
| | | 140 | 6.09 | 0.85 | 80 | 94 |
| | | 150 | 6.11 | 0.92 | 84 | 91 |
| | | 160 | 6.14 | 0.98 | 88 | 90 |
| | | 170 | 6.17 | 1.05 | 92 | 88 |
| | | 180 | 6.20 | 1.12 | 96 | 86 |
| | | 190 | 6.23 | 1.18 | 100 | 85 |
| | | 200 | 6.27 | 1.25 | 104 | 83 |
| 4000K | 90 | 50 | 5.71 | 0.29 | 35 | 119 |
| | | 100 | 5.96 | 0.60 | 63 | 105 |
| | | 110 | 5.99 | 0.66 | 68 | 103 |
| | | 120 | 6.03 | 0.72 | 73 | 101 |
| | | 130 | 6.06 | 0.79 | 78 | 98 |
| | | 140 | 6.09 | 0.85 | 72 | 97 |
| | | 150 | 6.11 | 0.92 | 76 | 94 |
| | | 160 | 6.14 | 0.98 | 91 | 93 |
| | | 170 | 6.17 | 1.05 | 95 | 91 |
| | | 180 | 6.20 | 1.12 | 99 | 89 |
| | | 190 | 6.23 | 1.18 | 103 | 87 |
| | | 200 | 6.27 | 1.25 | 107 | 85 |

# 3. Characteristics

## 1) Absolute Maximum Rating

| Item | Symbol | Rating | Condition |
|---|---|---|---|
| Operating temperature range | $T_{op}$ | -40℃ ~ +85℃ | - |
| Storage temperature range | $T_{stg}$ | -40℃ ~ +100℃ | - |
| LED junction temperature | $T_J$ | 125℃ | - |
| Forward Current | $I_F$ | 200 mA | - |
| Peak Pulsed Forward Current | $I_{FP}$ | 400 mA | Duty 1/10 pulse width 10ms |
| Thermal resistance | $R_{th,\ j\text{-}s}$ | 15℃/W | Junction to solder point |
| Assembly Process Temperature | - | 260℃, < 10sec | - |
| ESD | - | 5kV | HBM |

## 2) Electro-optical Characteristics – Voltage and CRI

| Item | Unit | Rank | | Min | Typ | Max |
|---|---|---|---|---|---|---|
| Forward Voltage (@100 mA, Tj = 25℃) | V | YB | A1 | 5.6 | - | 5.8 |
| | | | A2 | 5.8 | - | 6.0 |
| | | | A3 | 6.0 | - | 6.2 |
| | | | A4 | 6.2 | - | 6.4 |
| | | | A5 | 6.4 | - | 6.6 |
| Reverse Voltage (@5 mA, Tj = 25℃) | V | - | | 0.7 | - | 1.2 |
| Color Rendering Index | Ra | 7 | | 90 | - | - |
| Special CRI[4] (R9) | - | - | | 50 | - | - |

**Notes:**

1)~2) SAMSUNG ELECTRONICS maintains a tolerance of $V_F$:±0.1 V, $R_a$ :±3.0 on measurements

## 3) Electro-optical Characteristics – Luminous Intensity and Flux

| Item | Unit | CCT | Rank | | Min | Typ | Max |
|---|---|---|---|---|---|---|---|
| Luminous Flux (@100 mA, Ts = 25℃) | lm | 2700K | S0 | S1 | 48.0 | - | 53.0 |
| | | | | S2 | 53.0 | - | 58.0 |
| | | | | S3 | 58.0 | - | 63.0 |
| | | 3000K | S0 | S1 | 50.0 | - | 55.0 |
| | | | | S2 | 55.0 | - | 60.0 |
| | | | | S3 | 60.0 | - | 65.0 |
| | | 3500K | S0 | S1 | 52.0 | | 57.0 |
| | | | | S2 | 57.0 | | 62.0 |
| | | | | S3 | 62.0 | | 67.0 |
| | | 4000K | S0 | S1 | 54.0 | | 59.0 |
| | | | | S2 | 59.0 | | 64.0 |
| | | | | S3 | 64.0 | | 69.0 |

**Notes:**

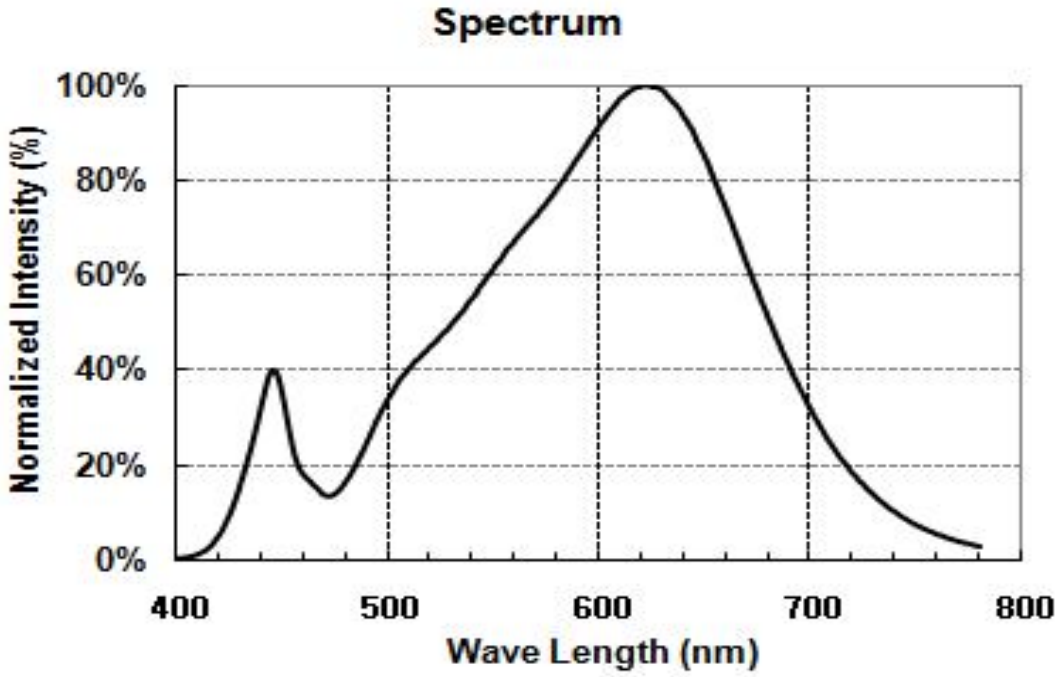
Luminous Intensity($I_v$, cd) values are for representative reference only

# 4. Typical Characteristics Graph

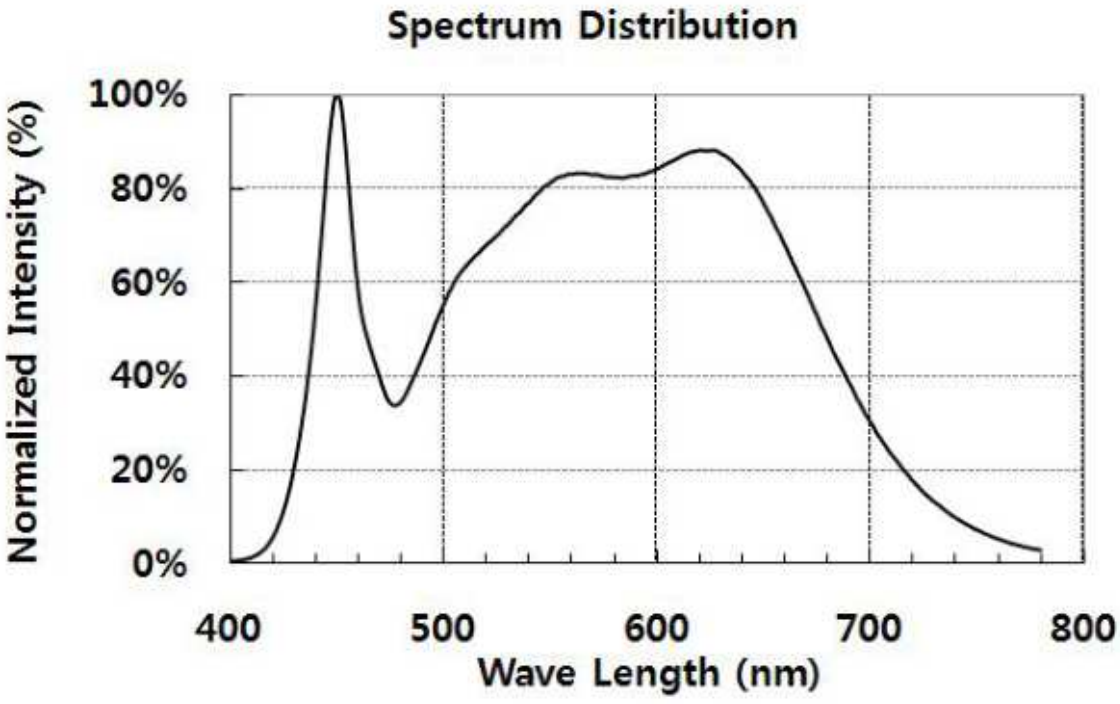
## 1) Spectrum Distribution

(Ts = 25℃)

**2700K & 3000K**



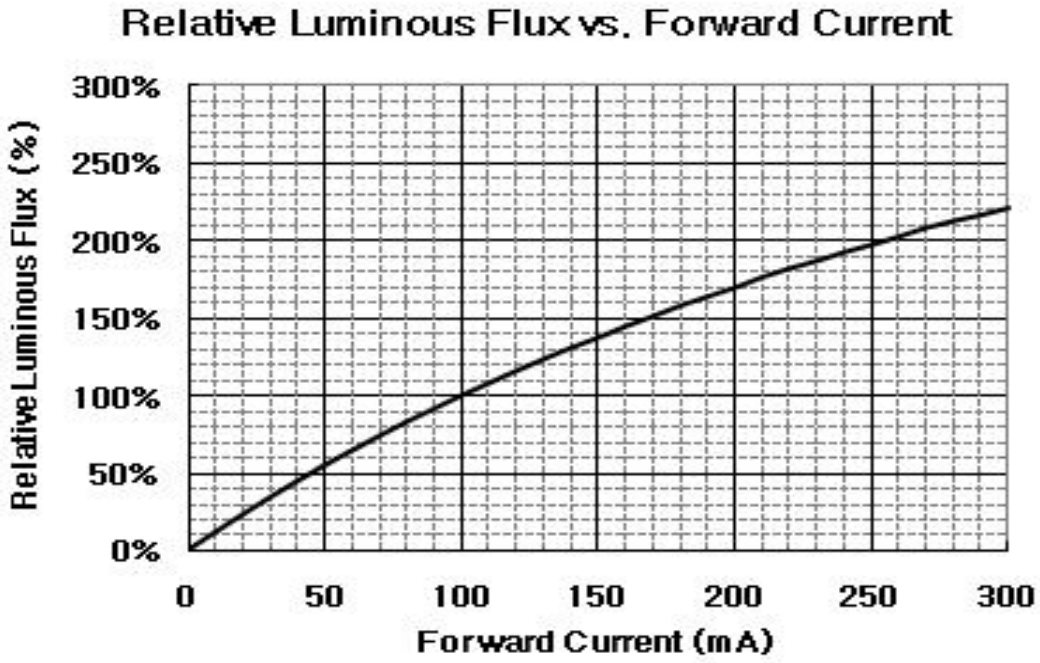

**3500K & 4000K**



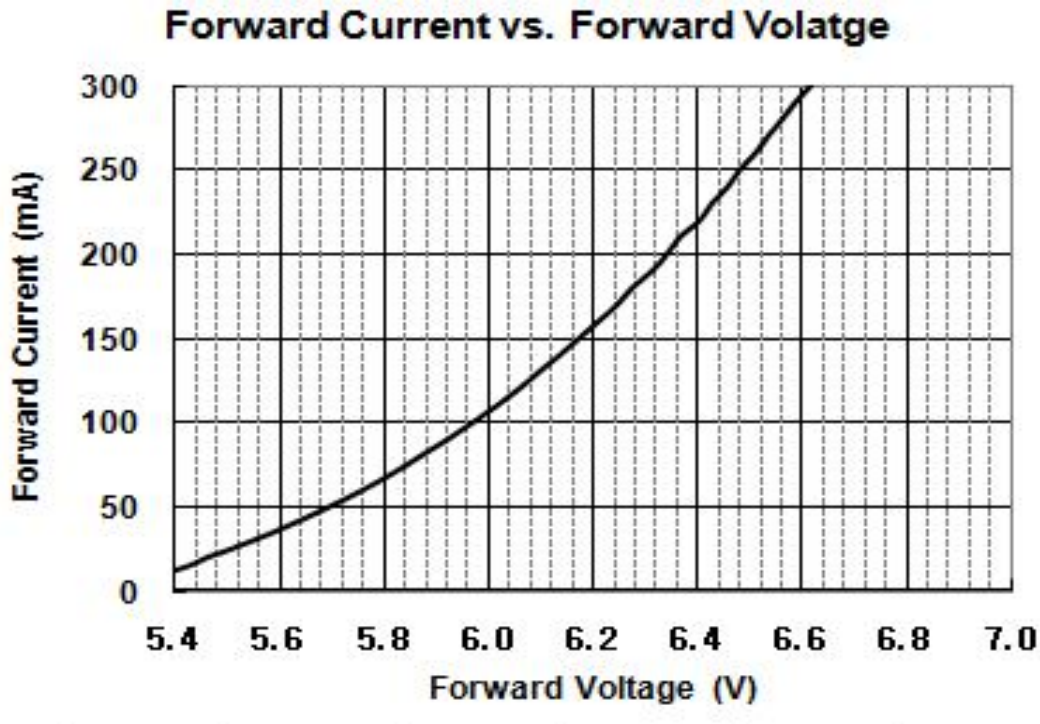
## 2) Forward Current Characteristics

(Ts = 25℃)

**Relative Flux vs. Forward Current**

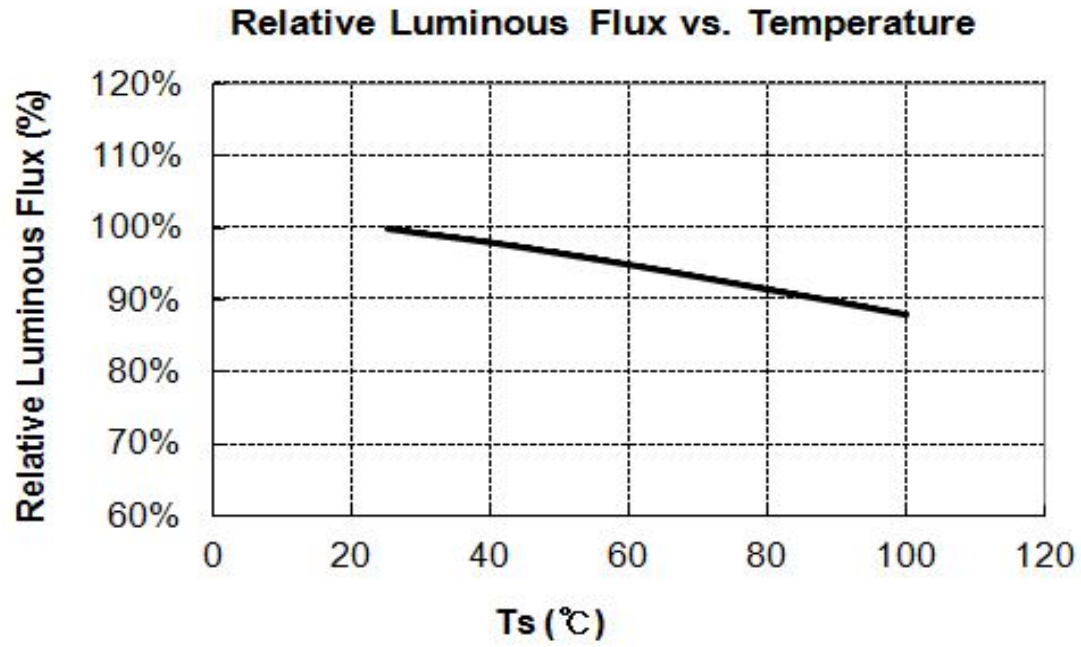



**Forward Current vs. Forward Voltage**

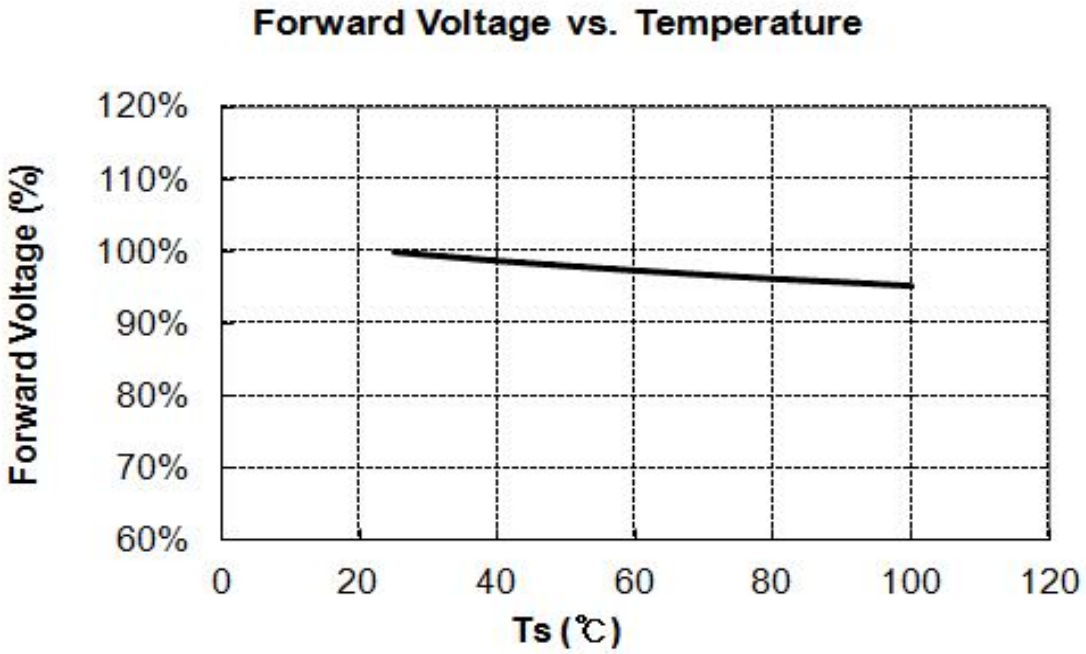


### 3) Temperature Characteristics

**Relative Flux vs. Ts(solder temp.) @ 100mA**

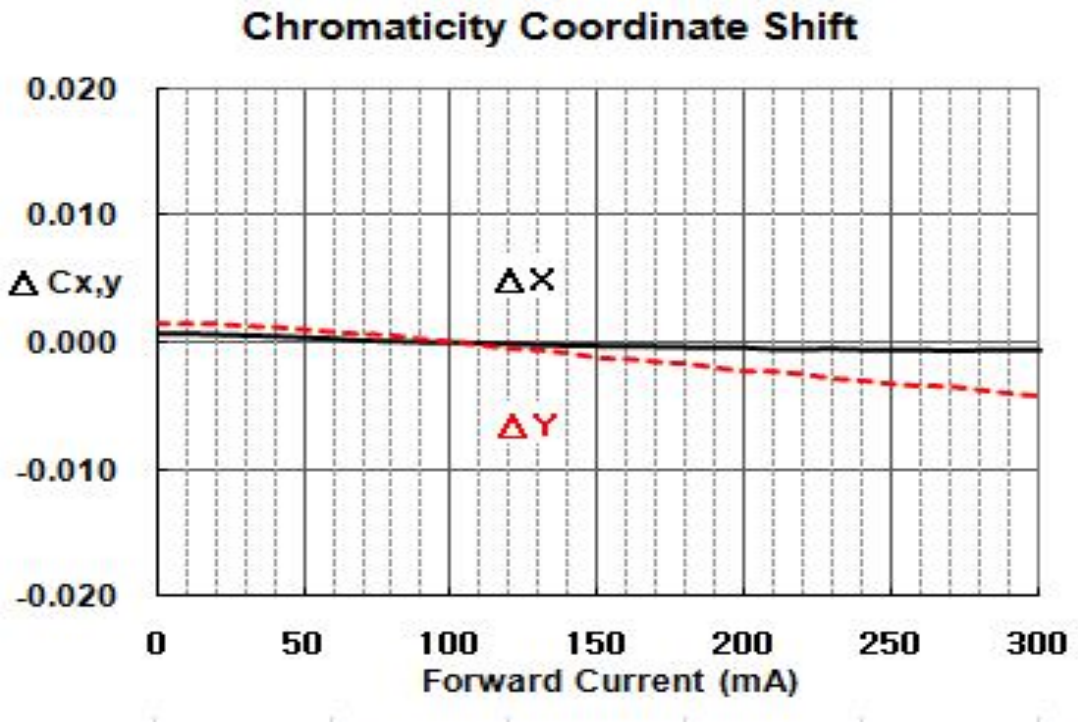



**Forward Voltage vs. Ts(solder temp.) @ 100mA**



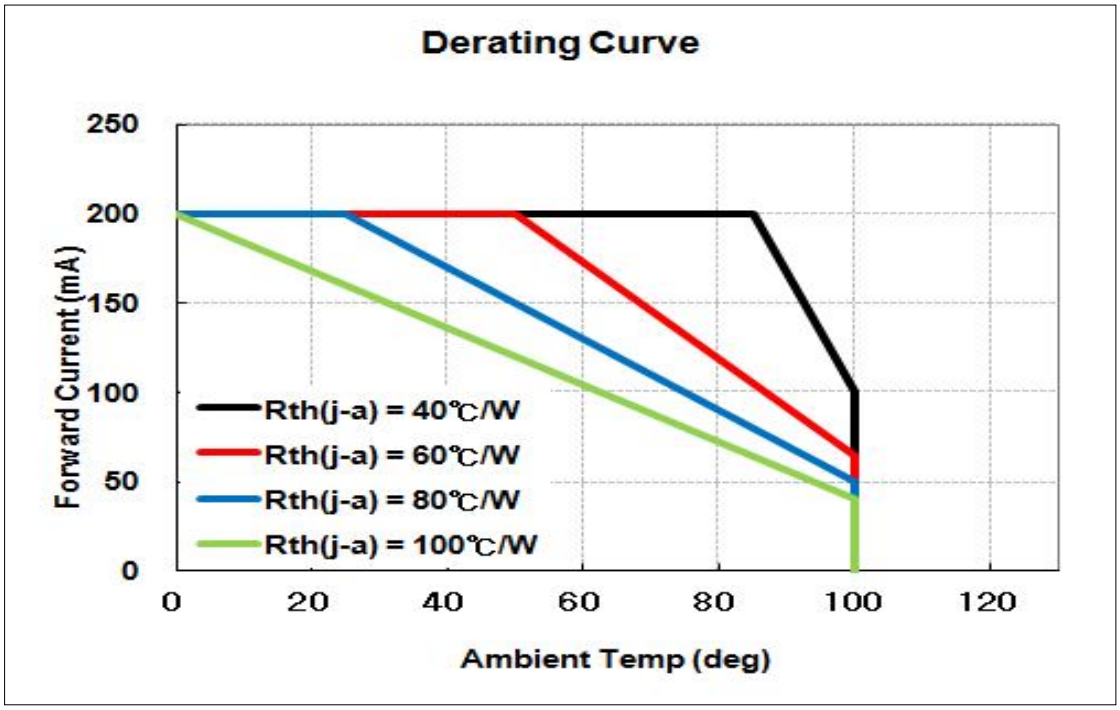
## 4) Color shift Characteristics

**Color x,y vs. Forward Current**



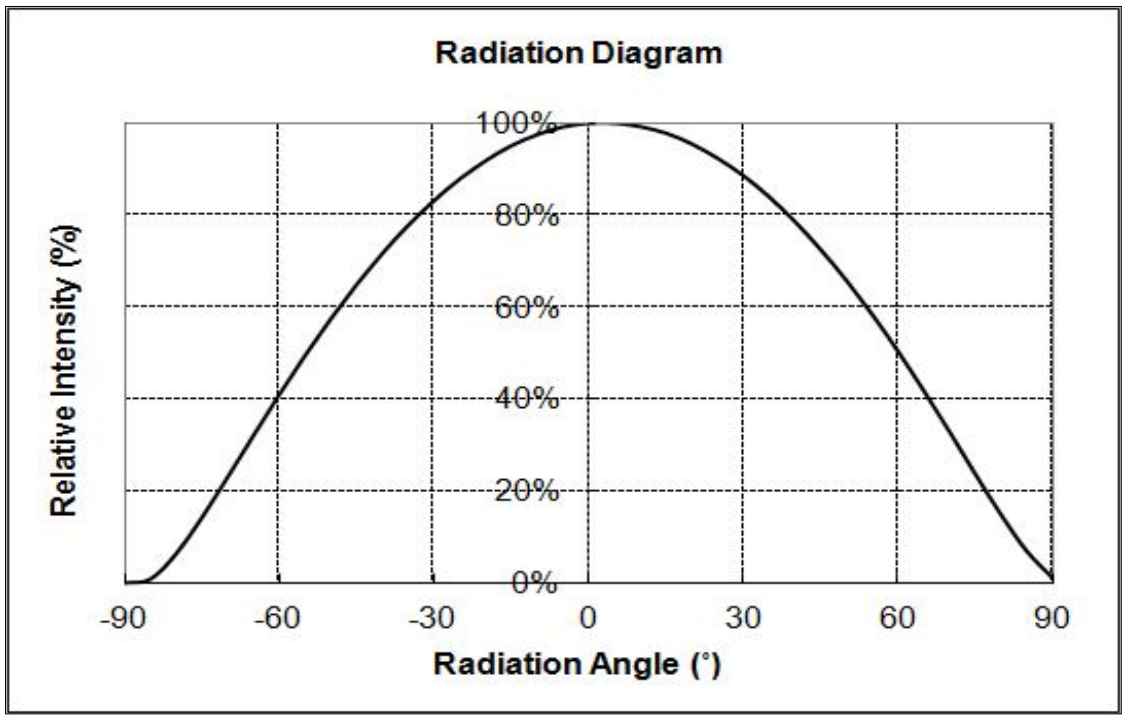
## 5) Derating Curve

($T_a$ = 25℃)

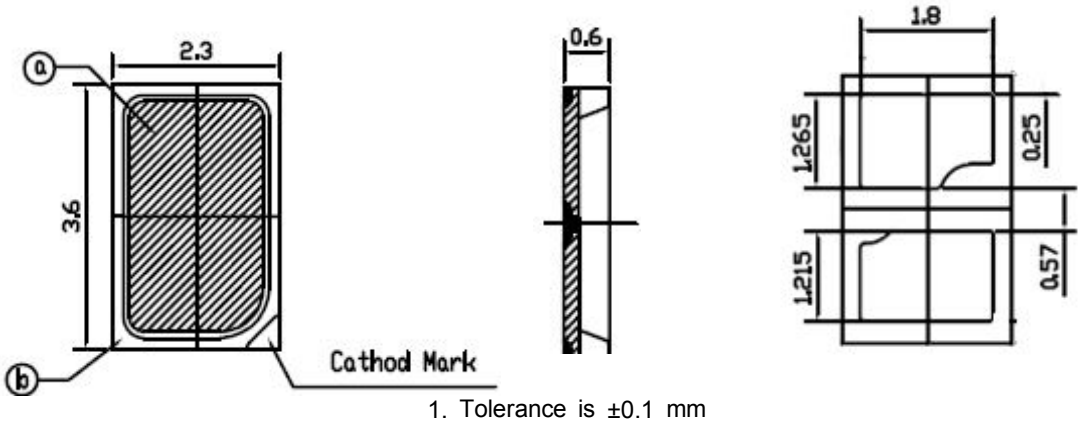



## 6) Viewing Angle Characteristics

Viewing Angle

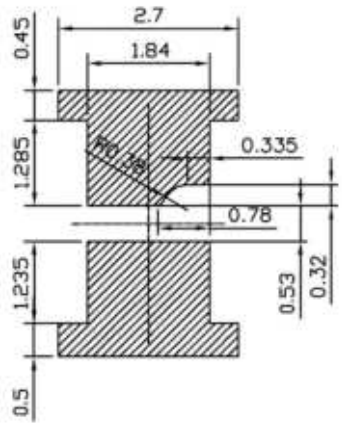


# 5. Outline Drawing and Dimension




1. Tolerance is ±0.1 mm
2. The maximum compressing force is 15N on the silicone ⓐ
3. Do not place pressure on the encapsulation resin ⓑ

### Recommended Land Pattern




**Notes:**

1) This LED has built-in ESD protection device(s) connected in parallel to LED Chip(s).

2) Ts point & measurement method

① Measure the nearest point to the thermal pad as shown above. If necessary, remove PSR of PCB to reach Ts point.

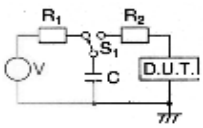
② Thermal pad must be soldered to the PCB to dissipate heat properly. Otherwise, LED can be damaged.

3) Precautions

① The pressure on the LEDs will influence to the reliability of the LEDs. Precautions should be taken to avoid the strong pressure on the LEDs. Do not put stress on the LEDs during heating.
② Re-soldering should not be done after the LEDs have been soldered. If re-soldering is unavoidable, LED`s characteristics should be carefully checked before and after such repair.
③ Do not stack assembled PCBs together. Since materials of LEDs is soft, abrasion between two PCB assembled with LED might cause catastrophic failure of the LEDs.

# 6. Reliability Test Items and Conditions

## 1) Test Items and Results

| Test Item | Test Conditions | | Test Hours/Cycles | Sample No |
|---|---|---|---|---|
| MSL Test | 125 ℃ 24hrs drying → 60 ℃, 60 %RH 120hrs → 260 ℃ 10sec 3 cycles | | 1 cycle | 11 |
| Room Temperature life test | 25 ℃±3 ℃, DC200㎃ | | 1,000 hrs | 22 |
| High Temperature life test | 85 ℃±3 ℃, DC200 ㎃ | | 1,000 hrs | 22 |
| High Temperature humidity life test | 85℃±3 ℃, 85 %±2 %RH, DC200 ㎃ | | 1,000 hrs | 22 |
| Low Temperature life test | -40 ℃±3 ℃, DC200 ㎃ | | 1,000 hrs | 22 |
| Power Temperature Cycle | -40 ℃/20 min ↔ 85 ℃/20 min, Temp. change within 100min, on/off 5 min | | 100 cycles | 50 |
| Thermal Shock | -45 ℃/15 min ↔ 125 ℃/15 min, Temp. change within 5min → Hot plate 180 ℃ | | 200 cycles | 100 |
| High Temperature Storage | Ta=120 ℃±3 ℃ | | 1000 hrs | 11 |
| Low Temperature Storage | Ta=-40 ℃±3 ℃ | | 1000 hrs | 11 |
| ESD(HBM) |  | R1:10 ㏁, R2:1.5 ㏀, C:100 ㎊, V = ±5 kV | 5 times | 10 |
| ESD(MM) | | R1:10 ㏁, R2:0, C:200 ㎊, V = ±0.5 kV | 5 times | 10 |
| Vibration Test | 100~2000~100 Hz, 200 m/s2, Sweep 4 min, X, Y, Z 3 direction, each 1 cycle | | 4 cycles | 11 |
| Mechanical Shock Test | 1500G, 0.5 ms, | | 5 cycles | 11 |

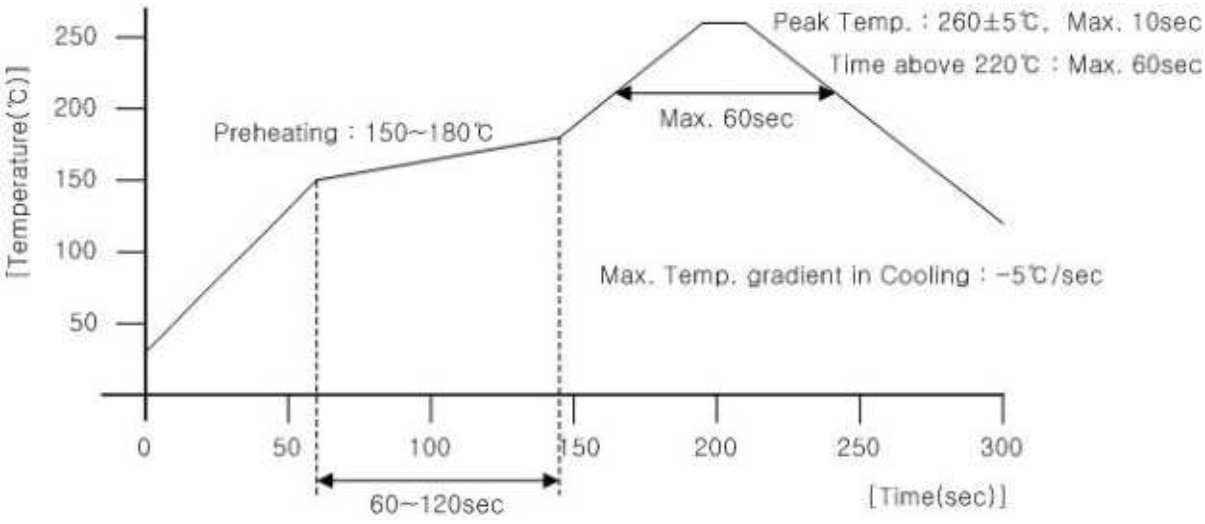
## 2) Criteria for Judging the Damage

| Item | Symbol | Test Condition | Limit | |
|---|---|---|---|---|
| | | | Min | Max |
| Forward Voltage | $V_F$ | $I_F$ = 100 ㎃ | Init. Value*0.9 | Init. Value*1.1 |
| Luminous Flux | Im | $I_F$ = 100 ㎃ | Init. Value*0.8 | Init. Value*1.2 |

# 7. Solder Conditions

## 1) Reflow Conditions ( Pb Free )

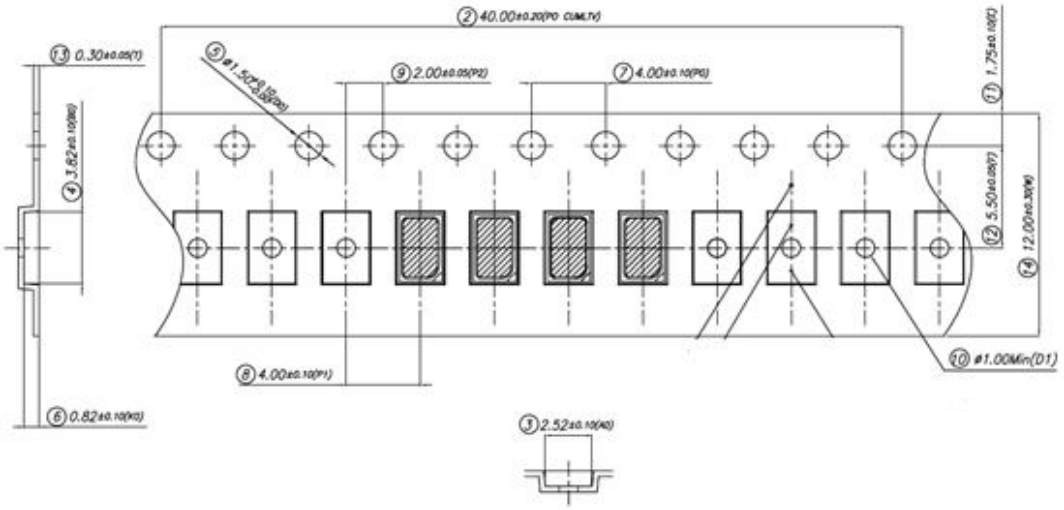
Reflow Frequency : 2 times max.



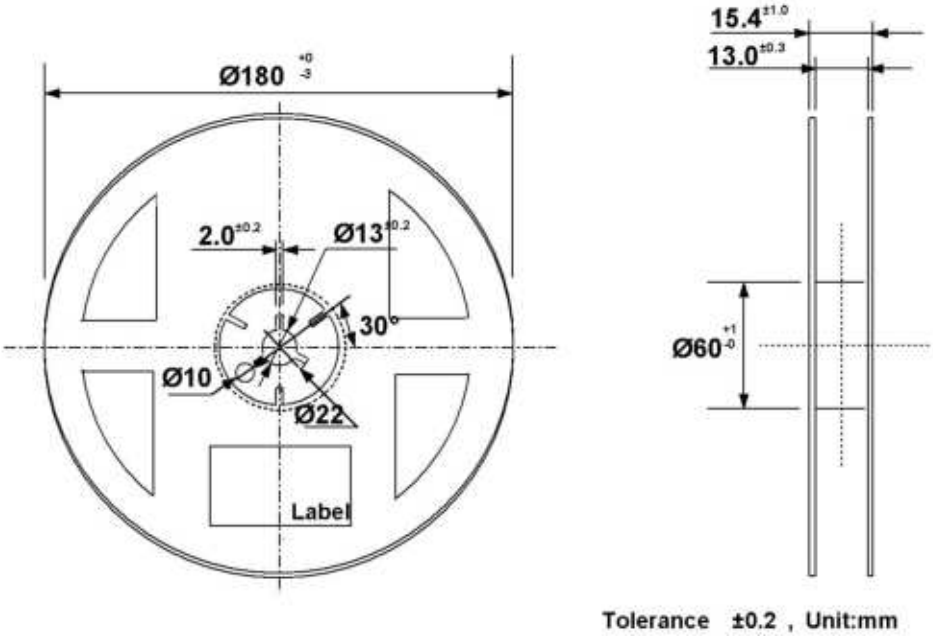

## 2) For Manual Soldering

Not more than 5 seconds @Max. 300℃, under soldering iron.

# 8. Tape And Reel



| End | | | Start |
|---|---|---|---|
| More than 40 ㎜ Unloaded tape | Mounted with Flash LED | More than (100~200)㎜ Unloaded tape | Leading part more than (200~400)㎜ |




(1) Quantity : The quantity/reel to be 4,000 pcs.

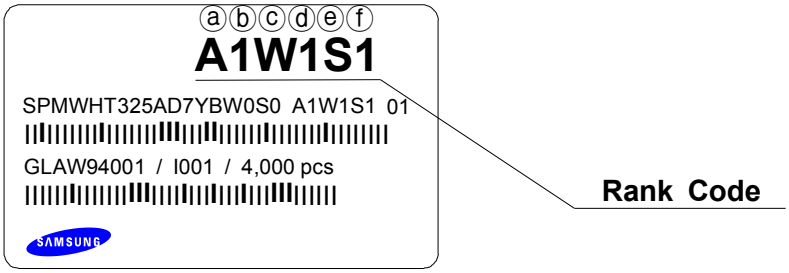
(2) Cumulative Tolerance : Cumulative tolerance/10 pitches to be ±0.2 ㎜

(3) Adhesion Strength of Cover Tape : Adhesion strength to be 0.1-0.7N when the cover tape is turned off from the carrier tape at 10° angle to be the carrier tape.

(4) Packaging : P/N, Manufacturing data code no. and quantity to be indicated on a damp proof package.

# 9. Label Structure

## 1) Label Structure




Rank Code

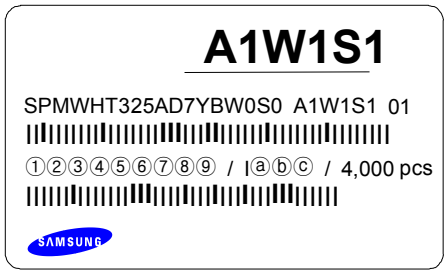
ⓐⓑ : Forward Voltage Rank

ⓒⓓ : Chromaticity Coordinate Rank

ⓔⓕ : Luminous Intensity Rank

## 2) LOT Number

The Lot number is composed of the following characters




①②③④⑤⑥⑦⑧⑨ / Ⅰⓐⓑⓒ / 4,000 PCS

① : Production Site (S:SAMSUNG LED, G:GOSIN CHINA)

② : L (LED)

③ : Product State (A:Normality, B:Bulk, C:First Production, R:Reproduction, S:Sample)

④ : Year (V:2011, W:2012, X:2013...)

⑤ : Month (1 ~ 9, A, B)

⑥ : Day (1 ~ 9, A, B ~ V)

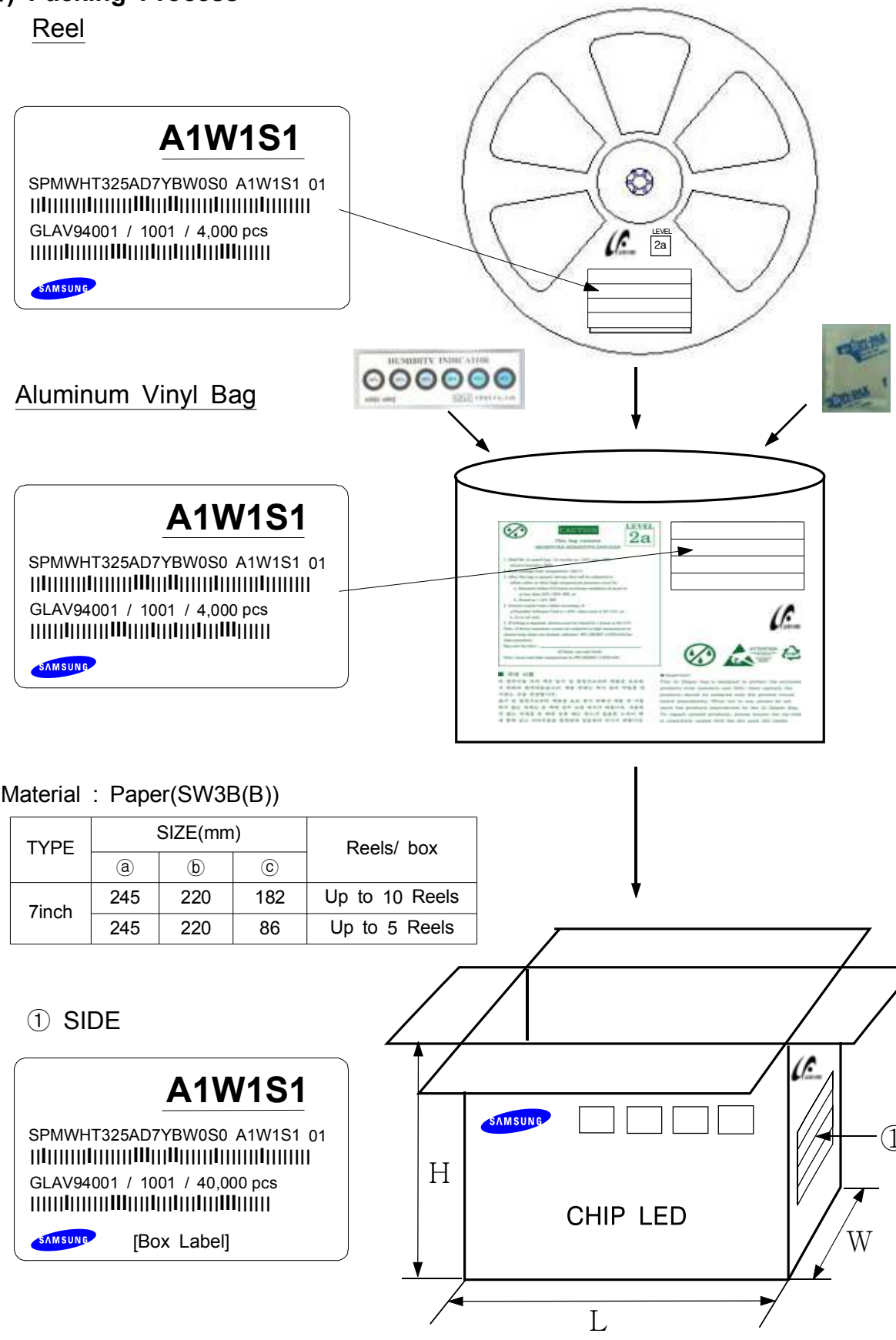
⑦⑧⑨ : SAMSUNG Electronics LED Product number (1 ~ 999)

ⓐⓑⓒ : Reel Number (1 ~ 999)

# 10. Packing Structure

## 1) Packing Process

Reel

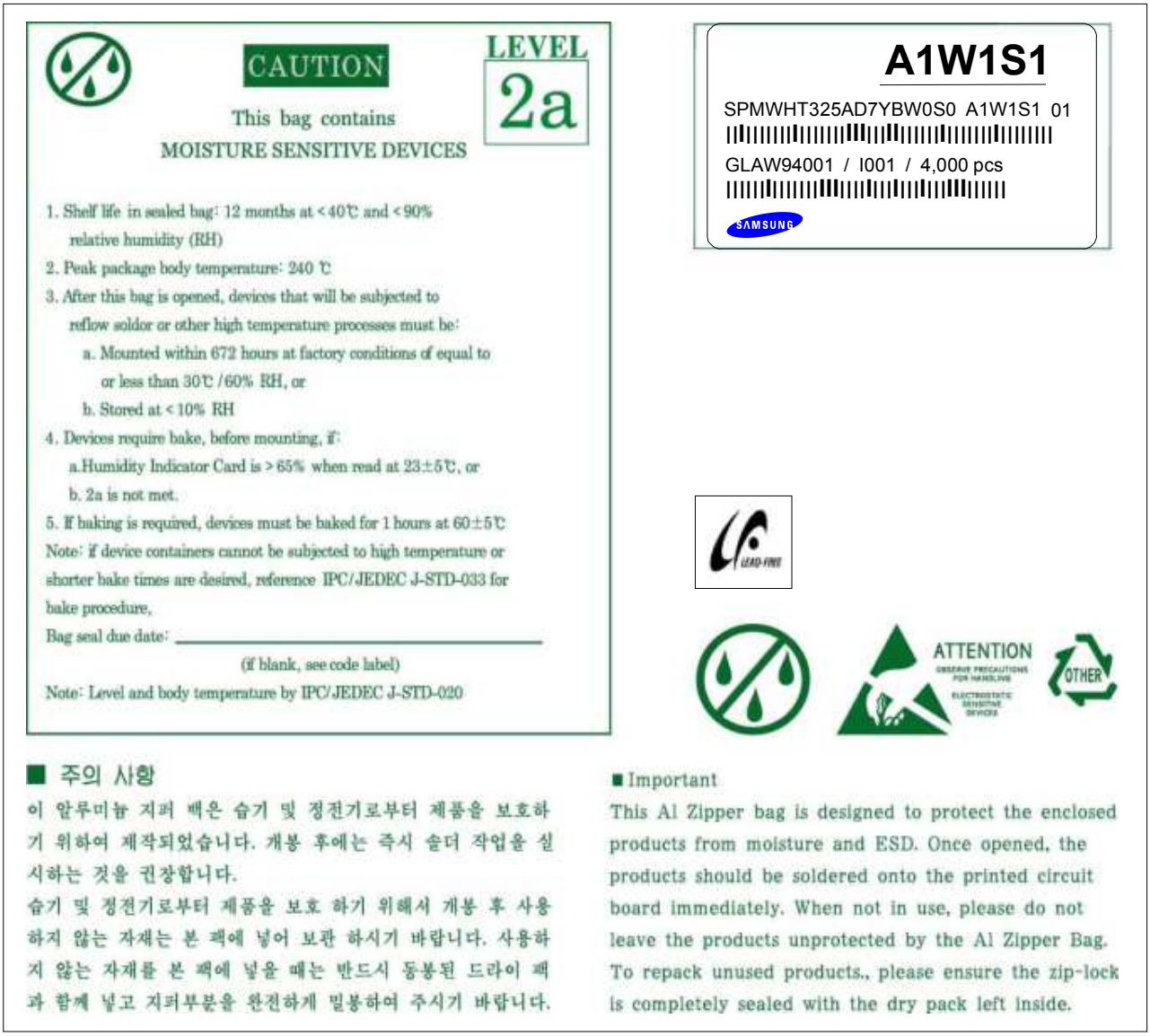



Material : Paper(SW3B(B))

| TYPE | SIZE(mm) | | | Reels/ box |
|---|---|---|---|---|
| | ⓐ | ⓑ | ⓒ | |
| 7inch | 245 | 220 | 182 | Up to 10 Reels |
| | 245 | 220 | 86 | Up to 5 Reels |

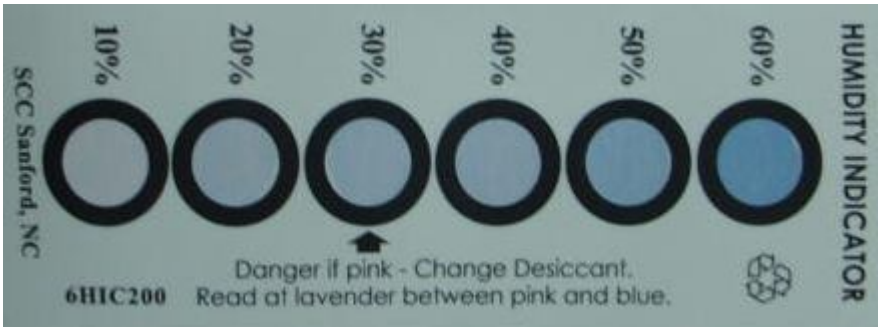
① SIDE

## 2) Aluminum Packing Bag




Silica gel & Humidity Indicator Card in Aluminum Vinyl Bag



# 11. Precaution for use

1) For over-current-proof function, customers are recommended to apply resistors to prevent sudden change of the current caused by slight shift of the voltage.
과전류 방지를 위해 전압의 미세한 이동에 의해 야기되는 전류의 순간 변화를 방지하기 위해 저항 등의 설치를 권장함.

2) This device should not be used in any type of fluid such as water, oil, organic solvent, etc. When washing is required, IPA is recommended to use.
제품은 물, 오일, 유기물과 같은 액체 타입에서의 사용은 제한되며,
세정이 필요할 시에는 IPA 사용을 권장함.

3) When the LEDs illuminate, operating current should be decided after considering the ambient maximum temperature.
LED의 발광 시, 동작 전류는 주변 최고온도를 고려하여 결정되어야 함.

4) LEDs must be stored in a clean environment.
If the LEDs are to be stored for 3 months or more after being shipped from Samsung Electronics, they should be packed by a sealed container with nitrogen gas injected.(Shelf life of sealed bags: 12 months, temp. ~40℃, ~90%RH)
LED의 보관은 청정한 환경에서 보존되어져야 하며, 만약 삼성전자로부터 공급받는 후 3개월 또는 그 이상 보관이 필요하다면 질소 가스를 동봉한 보존용기에 보관되어야 함.
(보존 bag의 수명 : 12 개월, 보존 온도 ~40℃, 습도 ~90%RH)

5) After storage bag is open, device subjected to soldering, solder reflow, or other high temperature processes must be:
보존 Bag이 개봉된 후에, 납땜이나 reflow등의 높은 온도에 노출되는 제품은 다음의 사항에 부합되어야 함.

a. Mounted within 672 hours(28 days) at an assembly line with a condition of no more than 30℃/60%RH,
a. 제품은 30℃/60%RH보다 같거나 낮은 조립조건에서 672시간(28일)이내에 조립해야 함.
b. Stored at <10%RH.
b. 10% 이하의 상대습도에서 보관되어야 함.

6) Repack unused Products with anti-moisture packing, fold to close any opening and then store in a dry place.
사용하지 않은 제품은 방습팩에 넣어 개봉 부위를 닫아서 다시 포장한 후,
건조한 장소에서 보관할 것을 권장함.

7) Devices require baking before mounting, if humidity card reading is >60% at 23±5℃.
만약 습도표시카드의 수치가 23±5℃에서 60% 이상이라면, 제품 실장 전 baking해야 함.

8) Devices must be baked for 1 hour at 60±5℃, if baking is required.
만약 baking이 필요하다면, 제품은 60±5℃에서 1시간 정도 baking 되어야 함.

9) The LEDs are sensitive to the static electricity and surge. It is recommended to use a wrist band or anti-electrostatic glove when handling the LEDs.
LED는 정전기 및 서지에 민감한 제품이므로, LED 제품을 다룰 시에는 정전기 방지장갑이나 손목밴드를 사용하기를 권장함.

If voltage exceeding the absolute maximum rating is applied to LEDs, it may cause damage or even destruction to LED devices.
만약 절대 허용치를 초과하는 전압이 LED에 가해지면, LED 소자는 파괴되거나 손상될 수 있음.

Damaged LEDs may show some unusual characteristics such as increase in leak current, lowered turn-on voltage, or abnormal lighting of LEDs at low current.
손상된 제품은 누설전류의 증가, Turn on 전압의 저하, 저 전류에서의 점등불량 등의 이상 거동을 보일 수 있음.

10) VOCs (volatile organic compounds) can be generated from adhesives, flux, hardener or organic additives used in luminaires (fixtures).
Transparent LED silicone encapsulant is permeable to those chemicals and they may lead a discoloration of encapsualnt when they expose to heat or light.
VOCs(휘발성 유기 화합물)는 등기구에 사용되는 접착제, Flux, 경화제, 유기물 첨가제에서 발생하여 LED 실리콘 봉지제를 투과하고, 빛 또는 열에 노출되었을 때 변색이 발생 할 수 있음.

This phenomenon can cause a significant loss of light emitted(output) from the luminaires(fixtures).
이러한 현상은 등기구로부터 나오는 빛의 중대한 손실을 줄 수 있음.

In order to prevent these problems, we recommend you to know the physical properties of the materials used in luminaires, They must be selected carefully.
이러한 문제 발생 방지를 위해서, 등기구에 사용되는 자재에 대한 물성을 알고 주의하여 선택 되어야함.

11) Risk of Sulfurization (or Tarnishing)

The LED from Samsung Electronics uses a silver-plated lead frame and its surface color may change to black(or dark colored) when it is exposed to sulfur(S), chlorine (Cl) or other halogen compound.

삼성전자의 LED는 Ag(은)을 도금한 리드프레임을 사용함. 이 리드프레임의 표면이 황(S), 염소(Cl), 또는 다른 할로겐 화합물들에 노출시 Ag(은)은 검정(또는 어두운색)으로 바뀔 수 있음.

Sulfurization of lead frame may cause intensity degradation, change of chromaticity coordinates and, in extreme cases, open circuit. It requires caution.

리드 프레임의 황화(Sulfurization)는 광량 저하, 색좌표 변화 및 심한 경우 LED 무등(Open) 불량을 일으킬 수도 있으니 주의가 필요함.

Due to possible sulfurization of lead frame, LED should not be used and stored together with oxidizing substances made of materials in a following list,
: Rubber, plain paper, lead solder cream and so on.

리드 프레임 황화(Sulfurization)의 근원이 될 수 있으니 LED는 아래의 목록으로 만들어진 산화성 물질들과 함께 저장, 사용이 불가함 : 고무, 일반 종이, 납땜 크림 등

# 12. Hazard Substance Analysis Report

SGS

**Test Report No.** F690101/LF-CTSAYAA13-52929 Issued Date: 2013. 11. 27 Page 1 of 6

To: **SAMSUNG ELECTRONICS CO., LTD.**
San #24,Nongseo-dong
Giheung-gu
Yongin-si
Gyeonggi-do
Korea

The following merchandise was submitted and identified by the client as :

| | |
|---|---|
| **SGS File No.** | : AYAA13-52929 |
| **Product Name** | : 3623 White PKG |
| **Item No./Part No.** | : N/A |
| **Received Date** | : 2013. 11. 20 |
| **Test Period** | : 2013. 11. 21 to 2013. 11. 27 |
| **Test Results** | : For further details, please refer to following page(s) |
| **Test Performed** | : SGS Korea tested the sample(s) selected by applicant with following results. |
| **Job Comments** | : By the applicant's specific request, the sampling and testing was performed only for the part indicated in the photo without disassembly. |

**SGS Korea Co., Ltd.**

**Timothy Jeon**
**Jinhee Kim**
**Cindy Park**
**Jerry Jung/ Testing Person**

**Jeff Jang / Chemical Lab Mgr**

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Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

SGS

**Test Report No.** F690101/LF-CTSAYAA13-52929 Issued Date: 2013. 11. 27 Page 2 of 6

**Sample No.** : AYAA13-52929.001
**Sample Description** : 3623 White PKG
**Item No./Part No.** : N/A
**Materials** : N/A

**Heavy Metals**

| Test Items | Unit | Test Method | MDL | Results |
|---|---|---|---|---|
| Cadmium (Cd) | mg/kg | With reference to IEC 62321:2013, ICP | 0.5 | N.D. |
| Lead (Pb) | mg/kg | With reference to IEC 62321:2013, ICP | 5 | N.D. |
| Mercury (Hg) | mg/kg | With reference to IEC 62321:2013, ICP | 2 | N.D. |
| Hexavalent Chromium (Cr VI) | mg/kg | With reference to IEC 62321:2008, UV-VIS | 1 | N.D. |

**Flame Retardants-PBBs/PBDEs**

| Test Items | Unit | Test Method | MDL | Results |
|---|---|---|---|---|
| Monobromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Dibromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Tribromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Tetrabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Pentabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Hexabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Heptabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Octabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Nonabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Decabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Monobromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Dibromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Tribromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Tetrabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Pentabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Hexabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Heptabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Octabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Nonabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Decabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |

NOTE:
(1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) Negative = Undetectable / Positive = Detectable
(6) ** = Qualitative analysis (No Unit)
(7) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

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Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.

SGS Korea Co.,Ltd. 522, The O valley, 655-8, Hogye-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t (+82-31) 4808 000 f (+82-31) 4808 058 http://www.sgsgroup.co.kr www.kr.sgs.com/environment

SGS

**Test Report No.** F690101/LF-CTSAYAA13-52929 Issued Date: 2013. 11. 27 Page 3 of 6

**Sample No.** : AYAA13-52929.001
**Sample Description** : 3623 White PKG
**Item No./Part No.** : N/A
**Materials** : N/A

**Halogen Content**

| Test Items | Unit | Test Method | MDL | Results |
|---|---|---|---|---|
| Bromine(Br) | mg/kg | BS EN 14582:2007 , IC | 30 | N.D. |
| Chlorine(Cl) | mg/kg | BS EN 14582:2007 , IC | 30 | N.D. |
| Fluorine(F) | mg/kg | BS EN 14582:2007 , IC | 30 | N.D. |
| Iodine(I) | mg/kg | BS EN 14582:2007 , IC | 50 | N.D. |

**Other(s)**

| Test Items | Unit | Test Method | MDL | Results |
|---|---|---|---|---|
| PFOS (Perfluorooctane Sulfonates-Acid/Metal Salt/Amide) | mg/kg | US EPA 3540C/3550C, LC/MS | 1 | N.D. |

NOTE:
(1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) Negative = Undetectable / Positive = Detectable
(6) ** = Qualitative analysis (No Unit)
(7) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

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Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 45 days only.

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**Picture of Sample as Received:**




NOTE:

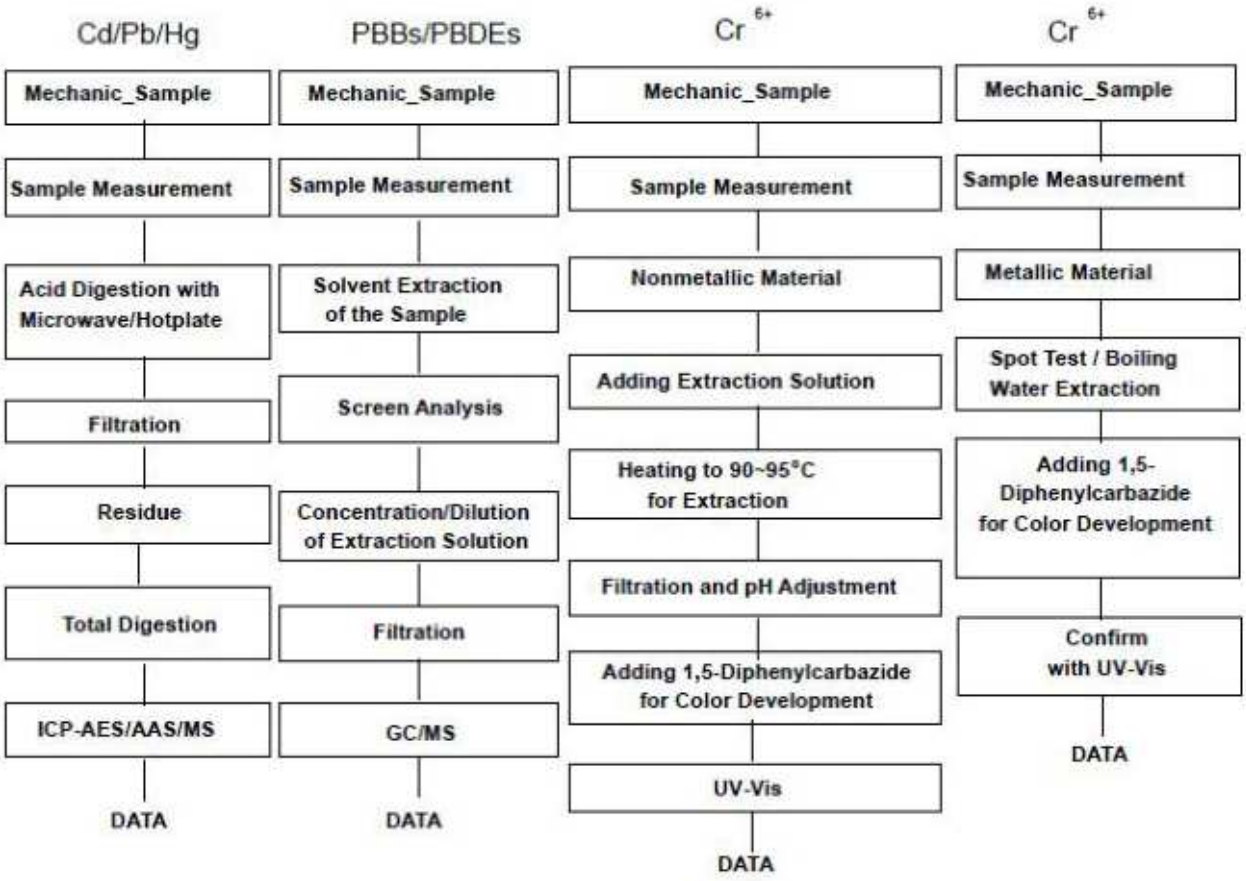
(1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) Negative = Undetectable / Positive = Detectable
(6) ** = Qualitative analysis (No Unit)
(7) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

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**Test Report No.** F690101/LF-CTSAYAA13-52929 Issued Date: 2013. 11. 27 Page 5 of 6

## Testing Flow Chart for RoHS:Cd/Pb/Hg/$Cr^{6+}$ /PBBs&PBDEs Testing



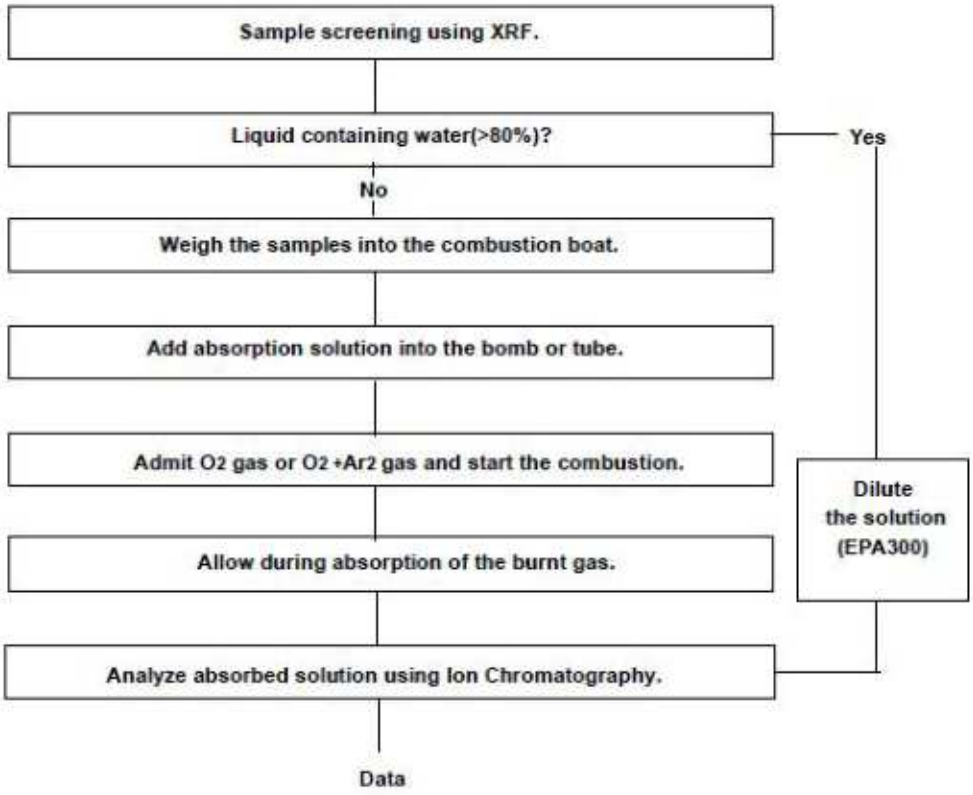

The samples were dissolved totally by pre-conditioning method according to above flow chart for Cd,Pb,Hg.
Section Chief : Gilsae Yi

NOTE:
(1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) Negative = Undetectable / Positive = Detectable
(6) ** = Qualitative analysis (No Unit)
(7) * = Boiling-water-extraction:
Negative = Absence of Cr\VI coating
Positive = Presence of Cr\VI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

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## Flow Chart for Halogen Test




*** End ***

NOTE:

(1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) Negative = Undetectable / Positive = Detectable
(6) ** = Qualitative analysis (No Unit)
(7) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
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# Test Report No. F690101/LF-CTSAYAA13-52928 Issued Date: 2013. 11. 27 Page 1 of 16

To. **SAMSUNG ELECTRONICS CO., LTD.**
95, Samsung 2-ro
Giheung-gu
Yongin-si
Gyeonggi-do
Korea

The following sample(s) was/were submitted and identified by/on behalf of the client as:-

| | | |
|---|---|---|
| **Product Name** | : | 3623 White PKG |
| **Item/Part Name** | : | N/A |
| **SGS File No.** | : | AYAA13-52928 |
| **Received Date** | : | 2013. 11. 20 |
| **Test Period** | : | 2013. 11. 21 ~ 2013. 11. 27 |
| **Test Performed** | : | SGS Korea tested the sample(s) selected by applicant with following results |
| **Test Requested** | : | One hundred-forty four (144) substances in the Candidate List of Substances of Very High Concern (SVHC) for authorization published by European Chemicals Agency (ECHA) on June 20, 2013 regarding Regulation (EC) No 1907/2006 concerning the REACH.<br><br>Seven(7) substances in the Public Consultation List of potential Substances of Very High Concern (SVHC) published by European Chemicals Agency (ECHA) on September 02, 2013 regarding Regulation (EC) No 1907/2006 concerning the REACH. |
| **Test Method** | : | Please refer to next page(s). |
| **Test Result(s)** | : | Please refer to next page(s). |

**SGS Korea Co., Ltd**

**Timothy Jeon**
**Cindy park**
**Jinhee Kim**
**Sophia Kim**
**/Testing Person**

Jeff Jang

**Jeff Jang / Chemical Lab Mgr**

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**Test Method:**

SGS In-House method - Analyzed by ICP-OES, PLM, UV/VIS, LC/MS ,GC/MS and colorimetric method

**Remarks:**

1. The chemical analysis of specified SVHC is performed by means of currently available analytical techniques against the following SVHC related documents published by ECHA:
   http://echa.europa.eu/web/guest/candidate-list-table (Candidate list)
   http://echa.europa.eu/proposals-to-identify-substances-of-very-high-concern-previous-consultations?p_p_id=substancetypelist_WAR_substanceportlet&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-1&p_p_col_pos=2&p_p_col_count=4&_substancetypelis
   (Proposals to identify SVHC consulations)
   This list is under evaluation by ECHA and may subject to change in the future.
2. In accordance with Regulation (EC) No 1907/2006, any producer or importer of articles shall notify ECHA, in accordance with paragraph 2 of Article 7, if a substance meets the criteria in Article 57 and is identified in accordance with Article 59(1) of the Regulation, if (a) the substance is present in those articles in quantities totaling over one tonne per producer or importer per year; and (b) the substance is present in those articles above a concentration of **0.1 %** weight by weight (w/w).
3. Article 33 of Regulation (EC) No 1907/2006 requires supplier of an article containing a substance meeting the criteria in Article 57 and identified in accordance with Article 59(1) in a concentration above **0.1 %** weight by weight (w/w) shall provide the recipient of the article with sufficient information, available to the supplier, to allow safe use of the article including, as a minimum, the name of that substance in the Candidate List.
4. SGS adopts the interpretation of ECHA for SVHC in article unless indicated otherwise. Detail explanation is available at the following link:
   http://webstage.contribute.sgs.net/corpreach/documents/SGS-CTS_SVHC-paper-EN-11.pdf
5. Test results in this report are based on the tested sample. This report refers to testing result of composite material group by equal weight proportion. The material in each composite test group may come from one article.
6. If a SVHC is found over the reporting limit, client is suggested to identify the component which contains the SVHC and the exact concentration of the SVHC by requesting further quantitative analysis from the laboratory.

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**Test Result(s)**

| Substance Name | CAS number | EC number | Concentration (%) | Reporting Limit (%) | Classification |
|---|---|---|---|---|---|
| Alkanes, C10-13, chloro (Short Chain Chlorinated Paraffins) | 85535-84-8 | 287-476-5 | N.D. | 0.05 | PBT |
| Anthracene | 120-12-7 | 204-371-1 | N.D. | 0.05 | PBT |
| Benzyl butyl phthalate (BBP) | 85-68-7 | 201-622-7 | N.D. | 0.05 | Toxic for Reproduction |
| Bis(2-ethylhexyl)phthalate (DEHP) | 117-81-7 | 204-211-0 | N.D. | 0.05 | Toxic for Reproduction |
| Bis(tributyltin)oxide | 56-35-9 | 200-268-0 | N.D. | 0.05 | PBT |
| Cobalt dichloride* | 7646-79-9 | 231-589-4 | N.D. | 0.005 | Carcinogen Toxic for Reproduction |
| 4,4-Diaminodiphenylmethane | 101-77-9 | 202-974-4 | N.D. | 0.05 | Carcinogen |
| Diarsenic pentaoxide* | 1303-28-2 | 215-116-9 | N.D. | 0.005 | Carcinogen |
| Diarsenic trioxide* | 1327-53-3 | 215-481-4 | N.D. | 0.005 | Carcinogen |
| Dibutyl phthalate (DBP) | 84-74-2 | 201-557-4 | N.D. | 0.05 | Toxic for Reproduction |
| Hexabromocyclododecane (HBCDD) and all major diastereoisomers identified (α-HBCDD, β-HBCDD, γ-HBCDD) | 25637-99-4 3194-55-6 (134237-51-7, 134237-50-6, 134237-52-8) | 247-148-4 221-695-9 | N.D. | 0.05 | PBT |
| Lead hydrogen arsenate* | 7784-40-9 | 232-064-2 | N.D. | 0.005 | Carcinogen Toxic for Reproduction |
| Sodium dichromate* (Sodium dichromate, dehydrate) | 10588-01-9 (7789-12-0) | 234-190-3 | N.D. | 0.005 | Carcinogen Mutagen Toxic for Reproduction |
| 5-tert-butyl-2,4,6-trinitro-m-xylene (musk xylene) | 81-15-2 | 201-329-4 | N.D. | 0.05 | vPvB |
| Triethyl arsenate* | 15606-95-8 | 427-700-2 | N.D. | 0.005 | Carcinogen |

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| Substance Name | CAS number | EC number | Concentration (%) | Reporting Limit (%) | Classification |
|---|---|---|---|---|---|
| Di-isobutyl phthalate(DIBP) | 84-69-5 | 201-553-2 | N.D. | 0.05 | Toxic for Reproduction |
| 2,4-Dinitrotoluene | 121-14-2 | 204-450-0 | N.D. | 0.05 | Carcinogen |
| Tris(2-chloroethyl) phosphate | 115-96-8 | 204-118-5 | N.D. | 0.05 | Toxic for Reproduction |
| Anthracene oil | 90640-80-5 | 292-602-7 | N.D. | 0.05 | PBT; vPvB Carcinogen |
| Anthracene oil, anthracene paste; distn. Lights | 91995-17-4 | 295-278-5 | N.D. | 0.05 | PBT; vPvB Carcinogen Mutagen |
| Anthracene oil, anthracene paste, anthracene fraction | 91995-15-2 | 295-275-9 | N.D. | 0.05 | PBT; vPvB Carcinogen Mutagen |
| Anthracene oil, anthracene-low | 90640-82-7 | 292-604-8 | N.D. | 0.05 | PBT; vPvB Carcinogen Mutagen |
| Anthracene oil, anthracene paste | 90640-81-6 | 292-603-2 | N.D. | 0.05 | PBT; vPvB Carcinogen Mutagen |
| Coal tar pitch, high temperature | 65996-93-2 | 266-028-2 | N.D. | 0.05 | PBT; vPvB Carcinogen |
| Lead sulfochromate yellow (C.I. Pigment Yellow 34)* | 1344-37-2 | 215-693-7 | N.D. | 0.005 | Carcinogen Toxic for Reproduction |
| Lead chromate molybdate sulfate red (C.I. Pigment Red 104)* | 12656-85-8 | 235-759-9 | N.D. | 0.005 | Carcinogen Toxic for Reproduction |
| Lead chromate* | 7758-97-6 | 231-846-0 | N.D. | 0.005 | Carcinogen Toxic for Reproduction |
| Acrylamide | 79-06-01 | 201-173-7 | N.D. | 0.05 | Carcinogen Mutagen |

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| Substance Name | CAS number | EC number | Concentration (%) | Reporting Limit (%) | Classification |
|---|---|---|---|---|---|
| Boric acid* | 10043-35-3<br>11113-50-1 | 233-139-2<br>234-343-4 | N.A. | 0.005 | Toxic for Reproduction |
| Disodium tetraborate, anhydrous* | 1330-43-4<br>12179-04-3<br>1303-96-4 | 215-540-4 | N.A. | 0.005 | Toxic for Reproduction |
| Tetraboron disodium heptaoxide, hydrate* | 12267-73-1 | 235-541-3 | N.A. | 0.005 | Toxic for Reproduction |
| Trichloroethylene | 79-01-6 | 201-167-4 | N.D. | 0.05 | Carcinogen |
| Sodium chromate* | 7775-11-3 | 231-889-5 | N.D. | 0.005 | Carcinogen<br>Mutagen<br>Toxic for Reproduction |
| Ammonium dichromate* | 7789-09-5 | 232-143-1 | N.D. | 0.005 | Carcinogen<br>Mutagen<br>Toxic for Reproduction |
| Potassium dichromate* | 7778-50-9 | 231-906-6 | N.D. | 0.005 | Carcinogen<br>Mutagen<br>Toxic for Reproduction |
| Potassium chromate* | 7789-00-6 | 232-140-5 | N.D. | 0.005 | Carcinogen<br>Mutagen |

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| Substance Name | CAS number | EC number | Concentration (%) | Reporting Limit (%) | Classification |
|---|---|---|---|---|---|
| Cobalt(II) sulphate* | 10124-43-3 | 233-334-2 | N.D. | 0.005 | Carcinogen<br>Toxic for Reproduction |
| Cobalt(II) dinitrate* | 10141-05-6 | 233-402-1 | N.D. | 0.005 | Carcinogen<br>Toxic for Reproduction |
| Cobalt(II) carbonate* | 513-79-1 | 208-169-4 | N.D. | 0.005 | Carcinogen<br>Toxic for Reproduction |
| Cobalt(II) diacetate* | 71-48-7 | 200-755-8 | N.D. | 0.005 | Carcinogen<br>Toxic for Reproduction |
| 2-Methoxyethanol | 109-86-4 | 203-713-7 | N.D. | 0.05 | Toxic for Reproduction |
| 2-Ethoxyethanol | 110-80-5 | 203-804-1 | N.D. | 0.05 | Toxic for Reproduction |
| Chromium trioxide* | 1333-82-0 | 215-607-8 | N.D. | 0.005 | Carcinogen<br>Mutagen |
| Acids generated from chromium trioxide and their oligomers:<br><br>Chromic acid<br>Dichromic acid<br><br>Oligomers of chromic acid and dichromic acid* | <br><br>7738-94-5<br>13530-68-2<br>- | <br><br>231-801-5<br>236-881-5<br>- | N.D. | 0.005 | Carcinogen |
| 1-methyl-2-pyrrolidone | 872-50-4 | 212-828-1 | N.D. | 0.05 | Toxic for Reproduction |
| 2-ethoxyethyl acetate | 111-15-9 | 203-839-2 | N.D. | 0.05 | Toxic for Reproduction |
| 1,2-benzenedicarboxylic acid, di-C6-8-branced alkyl esters, C7-rich | 71888-89-6 | 276-158-1 | N.D. | 0.05 | Toxic for Reproduction |
| 1,2-benzenedicarboxylic acid, di-C7-11-branched and linear alkyl esters | 68515-42-4 | 271-084-6 | N.D. | 0.05 | Toxic for Reproduction |
| 1,2,3-trichloropropane | 96-18-4 | 202-486-1 | N.D. | 0.05 | Carcinogen<br>Toxic for Reproduction |
| Hydrazine | 7803-57-8<br>302-01-2 | 206-114-9 | N.D. | 0.05 | Carcinogen |
| Strontium chromate* | 7789-06-2 | 232-142-6 | N.D. | 0.005 | Carcinogen |

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| Substance Name | CAS number | EC number | Concentration (%) | Reporting Limit (%) | Classification |
|---|---|---|---|---|---|
| 1,2-Dichloroethane | 107-06-2 | 203-458-1 | N.D. | 0.05 | Carcinogenic |
| 2,2'-dichloro-4,4'-methylenedianiline (MOCA) | 101-14-4 | 202-918-9 | N.D. | 0.05 | Carcinogenic |
| 2-Methoxyaniline o-Anisidine | 90-04-0 | 201-963-1 | N.D. | 0.05 | Carcinogenic |
| 4-(1,1,3,3-tetramethylbutyl) phenol, (4-tert-Octylphenol) | 140-66-9 | 205-426-2 | N.D. | 0.05 | Equivalent level of concern having probable serious effects to the environment |
| Aluminosilicate Refractory Ceramic Fibres* (RCF) | 650-017-00-8 (Index no.) | - | N.D. | 0.005 | Carcinogenic |
| Arsenic acid* | 7778-39-4 | 231-901-9 | N.D. | 0.005 | Carcinogenic |
| Bis(2-methoxyethyl) ether | 111-96-6 | 203-924-4 | N.D. | 0.05 | Toxic for reproduction |
| Bis(2-methoxyethyl) phthalate | 117-82-8 | 204-212-6- | N.D. | 0.05 | Toxic for reproduction |
| Calcium arsenate* | 7778-44-1 | 231-904-5 | N.D. | 0.005 | Carcinogenic |
| Dichromium tris(chromate)* | 24613-89-6 | 246-356-2 | N.D. | 0.005 | Carcinogenic |
| Formaldehyde, oligomeric reaction products with aniline (technical MDA) | 25214-70-4 | 500-036-1 | N.D. | 0.05 | Carcinogenic |
| Lead diazide* | 13424-46-9 | 236-542-1 | N.D. | 0.005 | Toxic for reproduction |
| Lead dipicrate* | 6477-64-1 | 229-335-2 | N.D. | 0.005 | Toxic for reproduction |
| Lead styphnate* | 15245-44-0 | 239-290-2 | N.D. | 0.005 | Toxic for reproduction |
| N,N-dimethylacetamide (DMAC) | 127-19-5 | 204-826-4 | N.D. | 0.05 | Toxic for reproduction |
| Pentazinc chromate octahydroxide* | 49663-84-5 | 256-418-0 | N.D. | 0.005 | Carcinogenic |
| Phenolphthalein | 77-09-8 | 201-004-7 | N.D. | 0.05 | Carcinogenic |
| Potassium hydroxyocta-oxodizincatedichromate* | 11103-86-9 | 234-329-8 | N.D. | 0.005 | Carcinogenic |
| Trilead diarsenate* | 3687-31-8 | 222-979-5 | N.D. | 0.005 | Carcinogenic<br>Toxic for reproduction |
| Zirconia Aluminosilicate Refractory Ceramic Fibres (Zr-RCF)* | 650-017-00-8 (Index no.) | - | N.D. | 0.005 | Carcinogenic |

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| Substance Name | CAS number | EC number | Concentration (%) | Reporting Limit (%) | Classification |
|---|---|---|---|---|---|
| 1,2-bis(2-methoxyethoxy) ethane (TEGDME; triglyme) | 112-49-2 | 203-977-3 | N.D. | 0.05 | Toxic for reproduction |
| 1,2-dimethoxyethane; ethylene glycol dimethyl ether (EGDME) | 110-71-4 | 203-794-9 | N.D. | 0.05 | Toxic for reproduction |
| Diboron trioxide* | 1303-86-2 | 215-125-8 | N.A. | 0.005 | Toxic for reproduction |
| Formamide | 75-12-7 | 200-842-0 | N.D. | 0.05 | Toxic for reproduction |
| Lead(II) bis(methanesulfonate)* | 17570-76-2 | 401-750-5 | N.D. | 0.005 | Toxic for reproduction |
| TGIC(1,3,5-tris (oxiranyl methyl)-1,3,5-triazine-2,4,6(1H,3H,5H)-trione) | 2451-62-9 | 219-514-3 | N.D. | 0.05 | Mutagenic |
| β-TGIC (1,3,5-tris[(2S and 2R)-2,3-epoxypropyl]-1,3,5-triazine-2,4,6-(1H,3H,5H)-trione)** | 59653-74-6 | 423-400-0 | N.D. | 0.05 | Mutagenic |
| 4,4'-bis(dimethylamino) benzophenone (Michler's ketone) | 90-94-8 | 202-027-5 | N.D. | 0.05 | Carcinogenic |
| N,N,N',N'-tetramethyl-4,4'-methylenedianiline (Michler's base) | 101-61-1 | 202-959-2 | N.D. | 0.05 | Carcinogenic |
| [4-[4,4'-bis(dimethylamino) benzhydrylidene]cyclohexa-2,5-dien-1-ylidene] dimethylammonium chloride (C.I. Basic Violet 3) | 548-62-9 | 208-953-6 | N.D. | 0.05 | Carcinogenic |
| [4-[[4-anilino-1-naphthyl][4-(dimethylamino)phenyl]methylene]cyclohexa-2,5-dien-1-ylidene] dimethylammonium chloride (C.I. Basic Blue 26) | 2580-56-5 | 219-943-6 | N.D. | 0.05 | Carcinogenic |
| α,α-Bis[4-(dimethylamino) phenyl]-4 (phenylamino) naphthalene-1-methanol (C.I. Solvent Blue 4) | 6786-83-0 | 229-851-8 | N.D. | 0.05 | Carcinogenic |
| 4,4'-bis(dimethylamino)-4''-(methylamino)trityl alcohol | 561-41-1 | 209-218-2 | N.D. | 0.05 | Carcinogenic |

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| Substance Name | CAS number | EC number | Concentration (%) | Reporting Limit (%) | Classification |
|---|---|---|---|---|---|
| Bis(pentabromophenyl) ether (DecaBDE) | 1163-19-5 | 214-604-9 | N.D. | 0.05 | PBT<br>vPvB |
| Pentacosafluorotridecanoic acid | 72629-94-8 | 276-745-2 | N.D. | 0.05 | vPvB |
| Tricosafluorododecanoic acid | 307-55-1 | 206-203-2 | N.D. | 0.05 | vPvB |
| Henicosafluoroundecanoic acid | 2058-94-8 | 218-165-4 | N.D. | 0.05 | vPvB |
| Heptacosafluorotetradecanoic acid | 376-06-7 | 206-803-4 | N.D. | 0.05 | vPvB |
| 4-(1,1,3,3-tetramethylbutyl) phenol, ethoxylated - covering well-defined substances and UVCB substances, polymers and homologues | - | - | N.D. | 0.05 | Equivalent level of concern - probable serious effects on the environment |
| 4-Nonylphenol, branched and linear – substances with a linear and/or branched alkyl chain with a carbon number of 9 covalently bound in position 4 to phenol, covering also UVCB- and well-defined substances which include any of the individual isomers or a combination thereof | - | - | N.D. | 0.05 | Equivalent level of concern - probable serious effects on the environment |
| Diazene-1,2-dicarboxamide (C,C'-azodi(formamide)) | 123-77-3 | 204-650-8 | N.D. | 0.05 | Equivalent level of concern - probable serious effects on human health |
| Cyclohexane-1,2-dicarboxylic anhydride (Hexahydrophthalic anhydride - HHPA) | 85-42-7 | 201-604-9 | N.D. | 0.05 | Equivalent level of concern - probable serious effects on human health |

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| Substance Name | CAS number | EC number | Concentration (%) | Reporting Limit (%) | Classification |
|---|---|---|---|---|---|
| Hexahydromethylphathalic anhydride, Hexahydro-4-methylphathalic anhydride, Hexahydro-1-methylphathalic anhydride, Hexahydro-3-methylphathalic anhydride | 25550-51-0, 19438-60-9, 48122-14-1, 57110-29-9 | 247-094-1, 243-072-0, 256-356-4, 260-566-1 | N.D. | 0.05 | Equivalent level of concern - probable serious effects on human health |
| Methoxy acetic acid | 625-45-6 | 210-894-6 | N.D. | 0.05 | Toxic for reproduction equivalent level of concern -probable serious effects on human health and the environment |
| 1,2-Benzenedicarboxylic acid, dipentylester, branched and linear | 84777-06-0 | 284-032-2 | N.D. | 0.05 | Toxic for reproduction |
| Diisopentylphthalate (DIPP) | 605-50-5 | 210-088-4 | N.D. | 0.05 | Toxic for reproduction |
| N-pentyl-isopentylphtalate | - | - | N.D. | 0.05 | Toxic for reproduction |
| 1,2-Diethoxyethane | 629-14-1 | 211-076-1 | N.D. | 0.05 | Toxic for reproduction |
| N,N-dimethylformamide; dimethyl formamide | 68-12-2 | 200-679-5 | N.D. | 0.05 | Toxic for reproduction |
| Dibutyltin dichloride (DBT) | 683-18-1 | 211-670-0 | N.D. | 0.05 | Toxic for reproduction |
| Acetic acid, lead salt, basic* | 51404-69-4 | 257-175-3 | N.D. | 0.005 | Toxic for reproduction |
| Basic lead carbonate (trilead bis(carbonate)dihydroxide)* | 1319-46-6 | 215-290-6 | N.D. | 0.005 | Toxic for reproduction |
| Lead oxide sulfate (basic lead sulfate)* | 12036-76-9 | 234-853-7 | N.D. | 0.005 | Toxic for reproduction |
| [Phthalato(2-)]dioxotrilead (dibasic lead phthalate)* | 69011-06-9 | 273-688-5 | N.D. | 0.005 | Toxic for reproduction |

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| Substance Name | CAS number | EC number | Concentration (%) | Reporting Limit (%) | Classification |
|---|---|---|---|---|---|
| Dioxobis(stearato)trilead* | 12578-12-0 | 235-702-8 | N.D. | 0.005 | Toxic for reproduction |
| Fatty acids, C16-18, lead salts* | 91031-62-8 | 292-966-7 | N.D. | 0.005 | Toxic for reproduction |
| Lead bis(tetrafluoroborate)* | 13814-96-5 | 237-486-0 | N.D. | 0.005 | Toxic for reproduction |
| Lead cyanamidate* | 20837-86-9 | 244-073-9 | N.D. | 0.005 | Toxic for reproduction |
| Lead dinitrate* | 10099-74-8 | 233-245-9 | N.D. | 0.005 | Toxic for reproduction |
| Lead oxide (lead monoxide)* | 1317-36-8 | 215-267-0 | N.D. | 0.005 | Toxic for reproduction |
| Lead tetroxide (orange lead)* | 1314-41-6 | 215-235-6 | N.D. | 0.005 | Toxic for reproduction |
| Lead titanium trioxide* | 12060-00-3 | 235-038-9 | N.D. | 0.005 | Toxic for reproduction |
| Lead Titanium Zirconium Oxide* | 12626-81-2 | 235-727-4 | N.D. | 0.005 | Toxic for reproduction |
| Pentalead tetraoxide sulphate* | 12065-90-6 | 235-067-7 | N.D. | 0.005 | Toxic for reproduction |
| Pyrochlore, antimony lead yellow* | 8012-00-8 | 232-382-1 | N.D. | 0.005 | Toxic for reproduction |
| Silicic acid, barium salt, lead-doped* | 68784-75-8 | 272-271-5 | N.D. | 0.005 | Toxic for reproduction |
| Silicic acid, lead salt* | 11120-22-2 | 234-363-3 | N.D. | 0.005 | Toxic for reproduction |
| Sulfurous acid, lead salt, dibasic* | 62229-08-7 | 263-467-1 | N.D. | 0.005 | Toxic for reproduction |
| Tetraethyllead* | 78-00-2 | 201-075-4 | N.D. | 0.005 | Toxic for reproduction |
| Tetralead trioxide sulphate* | 12202-17-4 | 235-380-9 | N.D. | 0.005 | Toxic for reproduction |

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| Substance Name | CAS number | EC number | Concentration (%) | Reporting Limit (%) | Classification |
|---|---|---|---|---|---|
| Trilead dioxide phosphonate* | 12141-20-7 | 235-252-2 | N.D. | 0.005 | Toxic for reproduction |
| Furan | 110-00-9 | 203-727-3 | N.D. | 0.05 | Carcinogenic |
| Propylene oxide; 1,2-epoxypropane; methyloxirane | 75-56-9 | 200-879-2 | N.D. | 0.05 | Carcinogenic Mutagenic |
| Diethyl sulphate | 64-67-5 | 200-589-6 | N.D. | 0.05 | Carcinogenic Mutagenic |
| Dimethyl sulphate | 77-78-1 | 201-058-1 | N.D. | 0.05 | Carcinogenic |
| 3-ethyl-2-methyl-2-(3-methylbutyl)-1,3-oxazolidine | 143860-04-2 | 421-150-7 | N.D. | 0.05 | Toxic for reproduction |
| Dinoseb | 88-85-7 | 201-861-7 | N.D. | 0.05 | Toxic for reproduction |
| 4,4'-methylenedi-o-toluidine | 838-88-0 | 212-658-8 | N.D. | 0.05 | Carcinogenic |
| 4,4'-oxydianiline and its salts | 101-80-4 | 202-977-0 | N.D. | 0.05 | Carcinogenic Mutagenic |
| 4-Aminoazobenzene; 4-Phenylazoaniline | 60-09-3 | 200-453-6 | N.D. | 0.05 | Carcinogenic |
| 4-methyl-m-phenylenediamine (2,4-toluene-diamine) | 95-80-7 | 202-453-1 | N.D. | 0.05 | Carcinogenic |
| 6-methoxy-m-toluidine (p-cresidine) | 120-71-8 | 204-419-1 | N.D. | 0.05 | Carcinogenic |
| Biphenyl-4-ylamine | 92-67-1 | 202-177-1 | N.D. | 0.05 | Carcinogenic |
| o-aminoazotoluene | 97-56-3 | 202-591-2 | N.D. | 0.05 | Carcinogenic |
| o-Toluidine; 2-Aminotoluene | 95-53-4 | 202-429-0 | N.D. | 0.05 | Carcinogenic |
| N-methylacetamide | 79-16-3 | 201-182-6 | N.D. | 0.05 | Toxic for reproduction |
| 1-bromopropane; n-propyl bromide | 106-94-5 | 203-445-0 | N.D. | 0.05 | Toxic for reproduction |

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| Substance Name | CAS number | EC number | Concentration (%) | Reporting Limit (%) | Classification |
|---|---|---|---|---|---|
| Cadmium | 7440-43-9 | 231-152-8 | N.D. | 0.005 | Carcinogenic |
| Cadmium oxide | 1306-19-0 | 215-146-2 | N.D. | 0.005 | Carcinogenic |
| Dipentyl phthalate (DPP) | 131-18-0 | 205-017-9 | N.D. | 0.05 | Toxic for reproduction |
| 4-Nonylphenol, branched and linear, ethoxylated [substances with a linear and/or branched alkyl chain with a carbon number of 9 covalently bound in position 4 to phenol, ethoxylated covering UVCB- and well-defined substances, polymers and homologues, which include any of the individual isomers and/or combinations thereof] | - | - | N.D. | 0.05 | Equivalent level of concern having probable serious effects to the environment |
| Ammonium pentadecafluorooctanoate (APFO) | 3825-26-1 | 223-320-4 | N.D. | 0.05 | Toxic for reproduction |
| Pentadecafluorooctanoic acid (PFOA) | 335-67-1 | 206-397-9 | N.D. | 0.05 | Toxic for reproduction |

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| Substance Name | CAS number | EC number | Concentration (%) | Reporting Limit (%) | Classification |
|---|---|---|---|---|---|
| Dihexyl phthalate | 84-75-3 | 201-559-5 | N.D. | 0.05 | Toxic for reproduction |
| Trixylyl phosphate | 25155-23-1 | 246-677-8 | N.D. | 0.05 | Toxic for reproduction |
| Imidazolidine-2-thione; 2-imidazoline-2-thiol | 96-45-7 | 202-506-9 | N.D. | 0.05 | Toxic for reproduction |
| Disodium 4-amino-3-[[4'-[(2,4-diaminophenyl)azo][1,1'-biphenyl]-4-yl]azo] -5-hydroxy-6-(phenylazo)naphthalene-2,7-disulphonate (C.I. Direct Black 38) | 1937-37-7 | 217-710-3 | N.D. | 0.05 | Carcinogenic |
| Disodium 3,3'-[[1,1'-biphenyl]-4,4'-diylbis(azo)]bis(4-aminonaphthalene-1-sulphonate) (C.I. Direct Red 28) | 573-58-0 | 209-358-4 | N.D. | 0.05 | Carcinogenic |
| Cadmium sulphide | 1306-23-6 | 215-147-8 | N.D. | 0.005 | Carcinogenic Equivalent level of concern having probable serious effects to human health |
| Lead di(acetate) | 301-04-2 | 206-104-4 | N.D. | 0.005 | Toxic for reproduction |

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**Note:**

1. RL = Reporting Limit
2. N.D. = Not detected (lower than RL)

   N.A. = Not applicable for respective material type.

   The submitted sample was found to contain significant amount of specific element(s) of SVHC. Upon further test verification and also information provided from client, the possibility that the element(s) content originate from SVHC is very unlikely, even though their presence cannot be exclude entirely. It may be assumed that the detected element(s) have a non-SVHC source.
3. Definition of classification is listed in Appendix A of this report in accordance with 67/548/EEC and Regulation (EC) No 1907/2006. For detail information, Detail explanation is available at the following link:
   http://echa.europa.eu/web/guest/candidate-list-table (Candidate list)
   http://echa.europa.eu/proposals-to-identify-substances-of-very-high-concern-previous-consultations?p_p_id=substancetypelist_WAR_substanceportlet&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-1&p_p_col_pos=2&p_p_col_count=4&_substancetypelis
   (Proposals to identify SVHC consulations)
4. *.The test result is based on the calculation of selected element(s) / marker(s) and to the worst-case scenario. For detail information, please refer to the SGS REACH website: www.reach.sgs.com/substance-of-very-high-concern-analysis-information-page.htm

   The client is advised to review the chemical formulation to ascertain above metal substances present in the article.

   RL = 0.005% is evaluated for element (i.e. cobalt, arsenic, lead, sodium, chromium, chromium(VI), silicon, aluminum, zirconium, boron, and potassium respectively), except molybdenum RL=0.0005%

   0.1% (w/w) = 1,000 ppm = 1,000 mg/kg
5. **.β-TGIC is one of the isomers for TGIC compounds and hence, tested together. The reported test result is based the proposed ratio as according to ECHA dossier.

**Picture of Sample as Received :**




*** End of Report ***

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**Appendix A**

| Classification | Definition under 67/548/EEC and Regulation (EC) No 1907/2006 |
|---|---|
| Carcinogen Category 1: | Substances known to be carcinogenic to man. There is sufficient evidence to establish a causal association between human exposure to a substance and the development of cancer. |
| Carcinogen Category 2: | Substances which should be regarded as if they are carcinogenic to man. There is sufficient evidence to provide a strong presumption that human exposure to a substance may result in the development of cancer.<br>Generally on the basis of:<br>- appropriate long-term animal studies<br>- other relevant information. |
| Mutagen Category 1: | Substances known to be mutagenic to man. There is sufficient evidence to establish a causal association between human exposure to a substance and heritable genetic damage. |
| Mutagen Category 2: | Substances which should be regarded as if they are mutagenic to man. There is sufficient evidence to provide a strong presumption that human exposure to the substance may result in the development of heritable genetic damage, generally on the basis of:<br>- appropriate animal studies,<br>- other relevant information. |
| Toxic to Reproduction Category 1: | Substances known to impair fertility in humans. There is sufficient evidence to establish a causal relationship between human exposure to the substance and impaired fertility.<br>Substances known to cause developmental toxicity in humans. There is sufficient evidence to establish a causal relationship between human exposure to the substance and subsequent developmental toxic effects in the progeny. |
| Toxic to Reproduction Category 2: | Substances which should be regarded as if they impair fertility in humans. There is sufficient evidence to provide a strong presumption that human exposure to the substance may result in impaired fertility on the basis of:<br>- clear evidence in animal studies of impaired fertility in the absence of toxic effects, or, evidence of impaired fertility occurring at around the same dose levels as other toxic effects but which is not a secondary nonspecific consequence of the other toxic effects,<br>- other relevant information.<br>Substances which should be regarded as if they cause developmental toxicity to humans. There is sufficient evidence to provide a strong presumption that human exposure to the substance may result in developmental toxicity, generally on the basis of:<br>- clear results in appropriate animal studies where effects have been observed in the absence of signs of marked maternal toxicity, or at around the same dose levels as other toxic effects but which are not a secondary non-specific consequence of the other toxic effects,<br>- other relevant information. |
| PBT & vPvB: | Substances which are persistent, bioaccumulative and toxic (PBT) or very persistent and very bioaccumulative (vPvB) pose a particular challenge to the chemicals safety management. For these substances a "safe" concentration in the environment cannot be established with sufficient reliability. |

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# Revision History

| Date | No. | Revision History | Writer | |
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| | | | Drawn | Approved |
| 2014.02.05 | 001 | New version | N.R.KIM | S.B.YUN |
| 2014.03.03 | 002 | Out box 추가 | N.R.KIM | S.B.YUN |
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